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(71)Applicant : MATSUSHITA ELECTRIC IND CO LTD

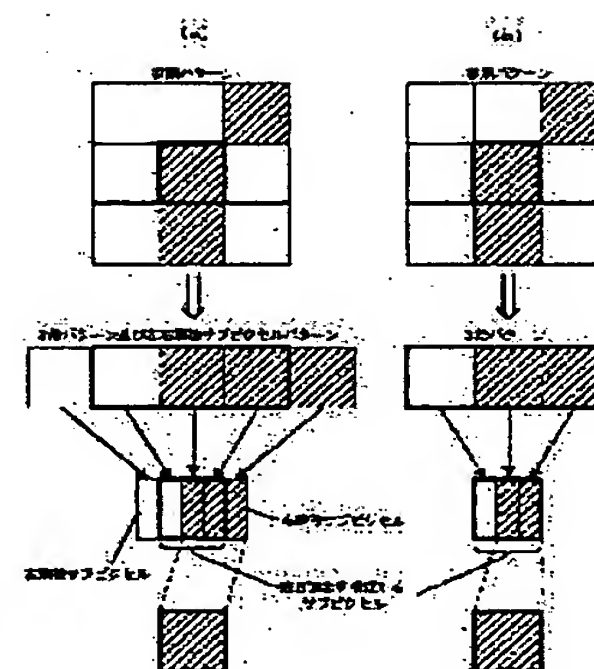
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(72)Inventor : TAJI BUNPEI
TEZUKA TADANORI
YOSHIDA HIROYUKI

(54) DISPLAY DEVICE, DISPLAY METHOD, AND RECORDING MEDIUM IN WHICH DISPLAY CONTROL PROGRAM IS RECORDED

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a display device which is suppressed in dispersion in output image density and provides high quality sub-pixel-display.
SOLUTION: A three-times-magnification pattern, an adjacent-left-sub-pixel pattern, and an adjacent-right-sub-pixel pattern are determined on the basis of a reference pattern consisting of eight pixels surrounding a center target pixel. The three-times-magnification pattern is allocated to the three sub-pixels constituting the target pixel, and the adjacent-left-sub-pixel pattern and adjacent-right-sub-pixel pattern are allocated to the left and right sub-pixels adjacent to the target pixel respectively. Because of this, a black part indicated by the target pixel moves for the distance of the width of one sub-pixel in the right direction without changing its size which is the same as that of three sub-pixels. As a result, dispersion in output image density caused by dispersion in the thickness of a line or the like can be suppressed.



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CLAIMS

[Claim(s)]

[Claim 1] The display characterized by performing the display moved in the 1st direction by k pieces of subpixel (k is the natural number), without in making a subpixel display perform by using as a former image the raster image by which the object is expressed changing the value of all j subpixel for j subpixel which displays the line when considering line breadth of the object after a subpixel display as j subpixel (j is the natural number).

[Claim 2] Install three light emitting devices which emit light in the RGB three primary colors, respectively in fixed sequence, and 1 pixel is constituted. The display device which installs this pixel in the 1st direction, constitutes one line, prepares two or more these lines in the 2nd direction which intersects perpendicularly in said 1st direction, and constitutes a display screen, A display image storage means to memorize the display image information which should be displayed on said display device, A display-control means to make it display on said display device based on the display-image information which said display-image storage means memorizes, A former image data storage means to memorize a preparation and the raster image which should be displayed this time, Only when it has the pixel value at which the attention pixel was appointed beforehand based on the raster image which said former image data storage means memorizes, while determining the 3 time pattern which expanded the attention pixel in said 1st direction 3 times It has a pattern decision means to determine the pattern of the subpixel which stands in a row in said 1st direction to the attention pixel concerned. For said display image storage means While the display image information based on said 3 time pattern which said pattern decision means determined, and the pattern of said subpixel is memorized, said pattern decision means In the raster image which said former image data storage means memorizes, surround said attention pixel. While determining the 3 time pattern which expanded the attention pixel concerned in said 1st direction 3 times according to the reference pattern which consists of a pixel of a sum total $(2n+1)(x(2m+1)-1)$ (n and m are the natural number) individual The pattern of said x subpixel (x is an integer) which stand in a row in one side to the attention pixel concerned, The pattern of said y subpixel (y is the natural number) which stand in a row in the other side is determined. Said display-control means Three light emitting devices which constitute 1 pixel, and said x light emitting devices which stand in a row in the one side of the 1 pixel, the display characterized by it being alike, receiving, assigning a pattern and the pattern of said subpixel said 3 times, and making it display it on said display device as said y light emitting devices which stand in a row in the other side.

[Claim 3] Install three light emitting devices which emit light in the RGB three primary colors, respectively in fixed sequence, and 1 pixel is constituted. The display device which installs this pixel in the 1st direction, constitutes one line, prepares two or more these lines in the 2nd direction which intersects perpendicularly in said 1st direction, and constitutes a display screen, A display image storage means to memorize the display image information which should be displayed on said display device, A display-control means to make it display on said display device based on the display-image information which said display-image storage means memorizes, While determining the 3 time pattern which expanded the attention pixel in said 1st direction 3 times based on the raster image which a former image data storage means to memorize a preparation and the raster image which should be displayed

this time, and said former image data storage means memorize A pattern decision means to determine the pattern of the subpixel which stands in a row in said 1st direction to the attention pixel concerned, It has a 3 time pattern amendment means to amend said 3 time pattern which said pattern decision means determined. For said display image storage means While the display image information based on the 3 time pattern after said amendment is memorized, said pattern decision means In the raster image which said former image data storage means memorizes An attention pixel, While determining said 3 time pattern which expanded the attention pixel concerned in said 1st direction 3 times according to the reference pattern of the rectangle which consists of a pixel of a sum total $(2n+1) \times (2m+1)$ (n and m are the natural number) individual which encloses this attention pixel The pattern of said x subpixel (x is an integer) which stand in a row in one side to the attention pixel concerned, The pattern of said y subpixel (y is the natural number) which stand in a row in the other side is determined. A pattern amendment means said 3 times When contradictory to the pattern of subpixel with which a pattern stands in a row in said 1st direction to other attention pixels said 3 times based on said attention pixel, a pattern is received the 3 times concerned. It is the display which amends so that the conflict may be removed, and is characterized by for said display-control means assigning the 3 time pattern after said amendment to three light emitting devices which constitute 1 pixel, and making it display on said display device.

[Claim 4] The display according to claim 2 which are $x=1$ and $y=1$.

[Claim 5] The display according to claim 3 which are $x=1$ and $y=1$.

[Claim 6] The display according to claim 2 or 4 which are $n=1$ and $m=1$.

[Claim 7] The display according to claim 3 or 5 which are $n=1$ and $m=1$.

[Claim 8] The raster image which said former image data storage means memorizes is a display given in seven from claim 2 characterized by being either the bitmapped image which carried out raster expansion of a bit-mapped font and the vector font, or the raster image which is not a font.

[Claim 9] Said pattern decision means is a display given in eight from claim 2 characterized by determining a pattern and the pattern of said subpixel said 3 times with reference to a reference pattern storage means to memorize the pattern decision rule which determines a pattern and the pattern of said subpixel said 3 times.

[Claim 10] The display according to claim 9 characterized by storing the information for pattern matching of a reference pattern in said reference pattern storage means.

[Claim 11] The display according to claim 9 characterized by for the bit string which carried out the bit expression of the reference pattern, and the information which shows said 3 time pattern concerning this bit string and the pattern of said subpixel matching, and storing it in said reference pattern storage means.

[Claim 12] Said pattern decision means is a display given in eight from claim 2 characterized by determining a pattern and the pattern of said subpixel said 3 times with reference to the result of an operation of a pattern logical operation means which performs logical operation based on said reference pattern.

[Claim 13] The method of presentation characterized by performing the display moved in the 1st direction by k pieces of subpixel (k is the natural number), without in making a subpixel display perform by using as a former image the raster image by which the object is expressed changing the value of all j subpixel for j subpixel which displays the line when considering line breadth of the object after a subpixel display as j subpixel (j is the natural number).

[Claim 14] Install three light emitting devices which emit light in the RGB three primary colors, respectively in fixed sequence, and 1 pixel is constituted. In the raster image which should be displayed this time in making it display on the display device which installs this pixel in the 1st direction, constitutes one line, prepares two or more these lines in the 2nd direction which intersects perpendicularly in said 1st direction, and constitutes a display screen Only when it has the pixel value at which the attention pixel was appointed beforehand, surround the attention pixel. While determining the 3 time pattern which expanded the attention pixel concerned in said 1st direction 3 times according to

the reference pattern which consists of a pixel of a sum total $(2n+1) \times (2m+1) - 1$ (n and m are the natural number) individual. The pattern of x subpixel (x is an integer) which stands in a row in said 1st direction to the one side of the attention pixel concerned, Three light emitting devices which determine the pattern of y subpixel (y is the natural number) which stands in a row in said 1st direction to the other side of the attention pixel concerned, and constitute 1 pixel, the method of presentation characterized by it being alike, receiving, assigning a pattern and the pattern of said subpixel said 3 times, and making it display it on said display device as said x light emitting devices which stand in a row in the one side of the 1 pixel, and said y light emitting devices which stand in a row in the other side.

[Claim 15] Install three light emitting devices which emit light in the RGB three primary colors, respectively in fixed sequence, and 1 pixel is constituted. In the raster image which should be displayed this time in making it display on the display device which installs this pixel in the 1st direction, constitutes one line, prepares two or more these lines in the 2nd direction which intersects perpendicularly in said 1st direction, and constitutes a display screen. The reference pattern of the rectangle which consists of an attention pixel and a pixel of the sum total $(2n+1) \times (2m+1)$ (n and m are the natural number) individual which encloses this attention pixel is followed. While determining said 3 time pattern which expanded the attention pixel concerned in said 1st direction 3 times. The pattern of x subpixel (x is an integer) which stands in a row in said 1st direction to the one side of the attention pixel concerned, The pattern of y subpixel (y is the natural number) which stands in a row in said 1st direction to the other side of the attention pixel concerned is determined. When contradictory to the pattern of subpixel with which a pattern stands in a row in said 1st direction to other attention pixels said 3 times based on said attention pixel, a pattern is received the 3 times concerned. The method of presentation characterized by amending so that the conflict may be removed, assigning the 3 time pattern after said amendment to three light emitting devices which constitute 1 pixel, and making it display on said display device.

[Claim 16] The method of presentation according to claim 14 which are $x=1$ and $y=1$.

[Claim 17] The method of presentation according to claim 15 which are $x=1$ and $y=1$.

[Claim 18] The method of presentation according to claim 14 or 16 which are $n=1$ and $m=1$.

[Claim 19] The method of presentation according to claim 15 or 17 which are $n=1$ and $m=1$.

[Claim 20] Said raster image is the method of presentation given in 19 from claim 14 characterized by being either the bitmapped image which carried out raster expansion of a bit-mapped font and the vector font, or the raster image which is not a font.

[Claim 21] The method of presentation given in 20 from claim 14 characterized by determining a pattern and the pattern of said subpixel said 3 times with reference to a reference pattern storage means to memorize the pattern decision rule which determines a pattern and the pattern of said subpixel said 3 times in case a pattern and the pattern of said subpixel are determined said 3 times.

[Claim 22] The method of presentation according to claim 21 characterized by storing the information for pattern matching of a reference pattern in said reference pattern storage means.

[Claim 23] The method of presentation according to claim 21 characterized by for the bit string which carried out the bit expression of the reference pattern, and the information which shows said 3 time pattern concerning this bit string and the pattern of said subpixel matching, and storing it in said reference pattern storage means.

[Claim 24] The method of presentation given in 20 from claim 14 characterized by determining a pattern and the pattern of said subpixel said 3 times with reference to the result of an operation of a pattern logical operation means which performs logical operation based on said reference pattern in case a pattern and the pattern of said subpixel are determined said 3 times.

[Claim 25] [when it is the program to which a subpixel display is made to carry out and considers line breadth of the object after a subpixel display as j subpixel (j is the natural number) by using as a former image the raster image by which the object is expressed] The record medium which recorded the display-control program to which the display which moved j subpixel which displays the line in the 1st

direction by k pieces of subpixel (k is the natural number), without changing the value of all j subpixel is made to carry out.

[Claim 26] Install three light emitting devices which emit light in the RGB three primary colors, respectively in fixed sequence, and 1 pixel is constituted. Install this pixel in the 1st direction, constitute one line, and two or more these lines are prepared in the 2nd direction which intersects perpendicularly in said 1st direction. In the raster image which is the program which makes it display on the display device which constitutes a display screen, and should be displayed this time Only when it has the pixel value at which the attention pixel was appointed beforehand, surround the attention pixel. While determining the 3 time pattern which expanded the attention pixel concerned in said 1st direction 3 times according to the reference pattern which consists of a pixel of a sum total $(2n+1) \times (2m+1) - 1$ (n and m are the natural number) individual The pattern of x subpixel (x is an integer) which stands in a row in said 1st direction to the one side of the attention pixel concerned, Three light emitting devices which determine the pattern of y subpixel (y is the natural number) which stands in a row in said 1st direction to the other side of the attention pixel concerned, and constitute 1 pixel, the record medium which recorded the display-control program which it is [program] alike, it receives [program], and you assign [program] a pattern and the pattern of said subpixel said 3 times, and makes it display it on said display device as said x light emitting devices which stand in a row in the one side of the 1 pixel, and said y light emitting devices which stand in a row in the other side.

[Claim 27] Install three light emitting devices which emit light in the RGB three primary colors, respectively in fixed sequence, and 1 pixel is constituted. Install this pixel in the 1st direction, constitute one line, and two or more these lines are prepared in the 2nd direction which intersects perpendicularly in said 1st direction. In the raster image which is the program which makes it display on the display device which constitutes a display screen, and should be displayed this time The reference pattern of the rectangle which consists of an attention pixel and a pixel of the sum total $(2n+1) \times (2m+1)$ (n and m are the natural number) individual which encloses this attention pixel is followed. While determining said 3 time pattern which expanded the attention pixel concerned in said 1st direction 3 times The pattern of x subpixel (x is an integer) which stands in a row in said 1st direction to the one side of the attention pixel concerned, The pattern of y subpixel (y is the natural number) which stands in a row in said 1st direction to the other side of the attention pixel concerned is determined. When contradictory to the pattern of subpixel with which a pattern stands in a row in said 1st direction to other attention pixels said 3 times based on said attention pixel, a pattern is received the 3 times concerned. The record medium which recorded the display-control program which it amends [program] so that the conflict may be removed, and you assign [program] the 3 time pattern after said amendment to three light emitting devices which constitute 1 pixel, and makes it display on said display device.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to a display and its related technique.

[0002]

[Description of the Prior Art] Before, the display using various display devices is used. Three light emitting devices which emit light in the RGB three primary colors, respectively, such as a color LCD and a color plasma display, are put in order in fixed sequence among such indicating equipments, and it considers as 1 pixel, and this pixel is installed in the 1st direction, one line is constituted, two or more these lines are prepared in the 2nd direction which intersects perpendicularly in the 1st direction, and there are some which constitute the display screen.

[0003] Now, like the display device carried in a cellular phone, a mobile computer, etc., for example, a display screen is comparatively narrow and there are also many display devices which a fine display cannot perform easily. If it is going to display a small alphabetic character, a photograph or a complicated picture, etc., some images will be crushed by such display device, and it will be easy to become indistinct with it.

[0004] In order to improve the visibility of a display in a narrow screen, the reference (title : "Sub Pixel Font Rendering Technology") about a subpixel display which used on the Internet the point that 1 pixel consisted of light emitting devices of three RGB is exhibited. this invention persons downloaded and checked this reference from a site (<http://grc.com>) or its subordinate on June 19, 2000.

[0005] Next, this technique is explained, referring to drawing 36 - drawing 40. Hereafter, the English character "A" is taken up as an example of the image to display.

[0006] Now, drawing 36 displays typically [one line] in the case of constituting 1 pixel from three light emitting devices in this way. The longitudinal direction (direction where the light emitting device of the RGB three primary colors is located in a line) in drawing 36 is called 1st direction, and the lengthwise direction which intersects perpendicularly with this is called 2nd direction.

[0007] In addition, although the method of a list of the others which are not the order of RGB is also considered, even if the method of a list of a light emitting device itself changes how to be located in a line, this conventional technique and this invention are applicable similarly.

[0008] And this 1 pixel (three light emitting devices) is arranged in a single tier in the 1st direction, and one line is constituted. Furthermore, this line is put in order in the 2nd direction and the display screen is constituted.

[0009] Now, with this subpixel technique, a former image is an image as shown in drawing 37. In this example, the alphabetic character "A" is displayed on the field of every 7 pixels of every direction. On the other hand, in order to perform a subpixel display, when it is considered that the light emitting device of each RGB is 1 pixel, as it is shown in drawing 38 about the field taken 7 pixels in the longitudinal direction in 21 (= 7x3) pixel and the lengthwise direction, the font which has one 3 times the resolution of this in a longitudinal direction is prepared.

[0010] And as shown in drawing 39, a color is defined about each pixel (not drawing 38 but pixel of drawing 37) of drawing 37. However, if it displays as it is, since an irregular color will occur, filtering processing by the multiplier as shown in drawing 40 (a) is performed. Drawing 40 (a) shows the multiplier to brightness, by 3/9 time and its next pixel, 2/9 time, further, it multiplies by the multiplier, such as 1/9 time, and the brightness of each pixel is adjusted by the next pixel, at a main attention pixel.

[0011] Thus, if filtering processing is performed to the pixel of the color shown in drawing 39, it will become like drawing 40 (b) and a color will be adjusted like dark blue with thin light blue with a thin light blue, yellow with thin yellow, brown with thin reddish brown, and dark blue.

[0012] Thus, the image which performed filtering processing is assigned to each light emitting device of

drawing 38 , and a subpixel display is performed.

[0013]

[Problem(s) to be Solved by the Invention] However, with this technique, the image (drawing 38) which expanded resolution in the 1st direction 3 times must be held separately and statically to a former image (drawing 37).

[0014] Generally, a big system resource is needed only by the class of font increasing like a font what manages many images all together. Especially, it is difficult like a cellular phone and a mobile computer to adopt the technique in which a big system resource in this way is needed what has many limits of a system resource.

[0015] Furthermore, since it will be the requisite that the image itself doubled three can use statically, the display which doubled resolution three cannot be performed about former images of arbitration, such as a photograph-of-his-face image downloaded from the server.

[0016] Thus, although it was not impossible in a Prior art to have performed a subpixel display, the burden of a system resource was large and there was a trouble that the range which can perform a subpixel display was restricted.

[0017] Then, this invention aims at offering a ream technique a display and in the meantime which the burden of a system resource is light, and can perform a subpixel display 3 times even if an image is not known, suppresses dispersion in the concentration of an output image and can moreover perform a high quality BUPIKUSERU display.

[0018]

[Means for Solving the Problem] Install three light emitting devices which emit light in the RGB three primary colors, respectively in fixed sequence, and 1 pixel is constituted from this invention. In the raster image which should be displayed this time in making it display on the display device which installs this pixel in the 1st direction, constitutes one line, prepares two or more these lines in the 2nd direction which intersects perpendicularly in the 1st direction, and constitutes a display screen. Only when it has the pixel value at which the attention pixel was appointed beforehand, surround the attention pixel. While determining the 3 time pattern which expanded the attention pixel concerned in the 1st direction 3 times according to the reference pattern which consists of a pixel of sum total $(2n+1) \times (2m+1) = 1$ (n and m are the natural number) individual. The pattern of x subpixel (x is an integer) which stands in a row in the 1st direction to the one side of the attention pixel concerned, Three light emitting devices which determine the pattern of y subpixel (y is the natural number) which stands in a row in the 1st direction to the other side of the attention pixel concerned, and constitute 1 pixel, it is alike, it receives, a pattern and the pattern of subpixel are assigned 3 times, and it is made to display it on a display device as x light emitting devices which stand in a row in the one side of the 1 pixel, and y light emitting devices which stand in a row in the other side

[0019] By this configuration, a pixel can be moved in the 1st direction by the migration width of face for one subpixel according to the value of "x" and "y", without changing a pixel value.

[0020] For this reason, in indicating by subpixel, dispersion in the concentration of the output image resulting from the line breadth showing an object changing can be controlled. Consequently, a high quality subpixel display is realizable.

[0021] Moreover, the burden of a system resource is light, and a subpixel display can be performed even if the image to which resolution was expanded 3 times is not known.

[0022] Install three light emitting devices which emit light in the RGB three primary colors, respectively in fixed sequence, and 1 pixel is constituted from this invention. In the raster image which should be displayed this time in making it display on the display device which installs this pixel in the 1st direction, constitutes one line, prepares two or more these lines in the 2nd direction which intersects perpendicularly in the 1st direction, and constitutes a display screen. While determining the 3 time pattern which expanded the attention pixel concerned in the 1st direction 3 times according to the reference pattern of the rectangle which consists of an attention pixel and a pixel of the sum total

$(2n+1) \times (2m+1)$ (n and m are the natural number) individual which encloses this attention pixel. The pattern of x subpixel (x is an integer) which stands in a row in the 1st direction to the one side of the attention pixel concerned, The pattern of y subpixel (y is the natural number) which stands in a row in the 1st direction to the other side of the attention pixel concerned is determined. When contradictory to the pattern of subpixel with which a pattern stands in a row in the 1st direction to other attention pixels 3 times based on an attention pixel, a pattern is received the 3 times concerned. It amends so that the conflict may be removed, and the 3 time pattern after amendment is assigned to three light emitting devices which constitute 1 pixel, and it is made to display on a display device.

[0023] By this configuration, a pixel can be moved in the 1st direction by the migration width of face for one subpixel according to the value of " x " and " y ", without changing a pixel value.

[0024] For this reason, in indicating by subpixel, dispersion in the concentration of the output image resulting from the line breadth showing an object changing can be controlled. Consequently, a high quality subpixel display is realizable.

[0025] And since it is removed, the conflict produced to a pattern 3 times does not need to process by sorting out a specific attention pixel, is performing the same processing uniformly to all attention pixels, and can determine a pattern and the pattern of subpixel 3 times.

[0026] Moreover, the burden of a system resource is light, and a subpixel display can be performed even if the image to which resolution was expanded 3 times is not known.

[0027]

[Embodiment of the Invention] The raster image by which the object is expressed is used as a former image in an indicating equipment according to claim 1: [when considering line breadth of the object after a subpixel display as j subpixel (j is the natural number) in making a subpixel display perform] The display moved in the 1st direction by k pieces of subpixel (k is the natural number) is performed without changing the value of all j subpixel for j subpixel which displays the line.

[0028] By this configuration, it hits performing a subpixel display and a smoother display can be realized compared with the case where the line breadth of the object of a former image is expanded or reduced simply.

[0029] Install three light emitting devices which emit light in the RGB three primary colors, respectively in fixed sequence, and 1 pixel is constituted from a display according to claim 2. The display device which installs this pixel in the 1st direction, constitutes one line, prepares two or more these lines in the 2nd direction which intersects perpendicularly in the 1st direction, and constitutes a display screen, It has a display image storage means to memorize the display image information which should be displayed on a display device, and a display-control means to make it display on a display device based on the display image information which a display image storage means memorizes.

[0030] Moreover, a former image data storage means to memorize the raster image which should display this indicating equipment this time, Only when it has the pixel value at which the attention pixel was appointed beforehand based on the raster image which a former image data storage means memorizes, while determining the 3 time pattern which expanded the attention pixel in the 1st direction 3 times It has a pattern decision means to determine the pattern of the subpixel which stands in a row in the 1st direction to the attention pixel concerned.

[0031] And the display image information based on the pattern of the 3 time pattern and subpixel which the pattern decision means determined as the display-image storage means is memorized.

[0032] In the raster image with which a former image data storage means memorizes a pattern decision means While determining the 3 time pattern which expanded the attention pixel concerned in the 1st direction 3 times according to the reference pattern which encloses an attention pixel and which consists of a pixel of sum total $(2n+1) \times (2m+1) - 1$ (n and m are the natural number) individual The pattern of x subpixel (x is an integer) which stands in a row in one side to the attention pixel concerned, and the pattern of y subpixel (y is the natural number) which stands in a row in the other side are determined.

[0033] a display-control means is boiled, receives, assigns a pattern and the pattern of subpixel 3 times, and makes it display it on a display device as three light emitting devices which constitute 1 pixel, x light emitting devices which stand in a row in the one side of the 1 pixel, and y light emitting devices which stand in a row in the other side

[0034] By this configuration, a pixel can be moved in the 1st direction by the migration width of face for one subpixel according to the value of "x" and "y", without changing a pixel value.

[0035] For this reason, in indicating by subpixel, dispersion in the concentration of the output image resulting from the line breadth showing an object changing can be controlled. Consequently, a high quality subpixel display is realizable.

[0036] Moreover, since processing which determines a pattern and the pattern of subpixel 3 times is performed only when it has the value at which the attention pixel was appointed beforehand, as compared with the case where these are determined to all attention pixels, the whole throughput is mitigable. Consequently, the burden of a system can be mitigated and a cellular phone, a mobile computer, etc. can be applied also to a device with many limits of a system resource.

[0037] And in order for a pattern decision means to determine a pattern and the pattern of subpixel dynamically 3 times based on the raster image which a former image data storage means memorizes, it is not necessary to hold a pattern and the pattern of subpixel statically 3 times. Therefore, compared with the case where a pattern and the pattern of subpixel are stored statically 3 times, the burden of a system is mitigable. thereby -- the above-mentioned effectiveness and a device with many [conjointly] limits of a system resource -- receiving -- more -- application -- it becomes easy.

[0038] Furthermore, a 3 time pattern [as opposed to this raster image to this raster image list] and the pattern of subpixel do not need to be known. For this reason, for example, about the image of large range, such as a photograph-of-his-face image downloaded from the server, the subpixel display which improved resolution substantially can be performed and it can display legible.

[0039] Install three light emitting devices which emit light in the RGB three primary colors, respectively in fixed sequence, and 1 pixel is constituted from a display according to claim 3. The display device which installs this pixel in the 1st direction, constitutes one line, prepares two or more these lines in the 2nd direction which intersects perpendicularly in the 1st direction, and constitutes a display screen. It has a display image storage means to memorize the display image information which should be displayed on a display device, and a display-control means to make it display on a display device based on the display image information which a display image storage means memorizes.

[0040] Moreover, while this indicating equipment determines the 3 time pattern which expanded the attention pixel in the 1st direction 3 times based on the raster image which a former image data storage means to memorize the raster image which should be displayed this time, and a former image data storage means memorize It has a pattern decision means to determine the pattern of the subpixel which stands in a row in the 1st direction to the attention pixel concerned, and a 3 time pattern amendment means to amend the 3 time pattern which the pattern decision means determined.

[0041] And the display image information based on the 3 time pattern after amendment is memorized by the display image storage means.

[0042] In the raster image with which a former image data storage means memorizes a pattern decision means While determining the 3 time pattern which expanded the attention pixel concerned in the 1st direction 3 times according to the reference pattern of the rectangle which consists of an attention pixel and a pixel of the sum total $(2n+1) \times (2m+1)$ (n and m are the natural number) individual which encloses this attention pixel The pattern of x subpixel (x is an integer) which stands in a row in one side to the attention pixel concerned, and the pattern of y subpixel (y is the natural number) which stands in a row in the other side are determined.

[0043] When contradictory to the pattern of subpixel with which a pattern stands in a row in the 1st direction to other attention pixels 3 times based on an attention pixel, a 3 time pattern amendment means amends so that the conflict may be removed to a pattern the 3 times concerned.

[0044] A display-control means assigns the 3 time pattern after amendment to three light emitting devices which constitute 1 pixel, and makes it display on a display device.

[0045] By this configuration, a pixel can be moved in the 1st direction by the migration width of face for one subpixel according to the value of "x" and "y", without changing a pixel value.

[0046] For this reason, in indicating by subpixel, dispersion in the concentration of the output image resulting from the line breadth showing an object changing can be controlled. Consequently, a high quality subpixel display is realizable.

[0047] And since it is removed, the conflict produced to a pattern 3 times does not need to process by sorting out a specific attention pixel, is performing the same processing uniformly to all attention pixels, and can determine a pattern and the pattern of subpixel 3 times.

[0048] Moreover, in order for a pattern decision means to determine a pattern and the pattern of subpixel dynamically 3 times based on the raster image which a former image data storage means memorizes, it is not necessary to hold a pattern and the pattern of subpixel statically 3 times. Therefore, compared with the case where a pattern and the pattern of subpixel are stored statically 3 times, the burden of a system can be mitigated and a cellular phone, a mobile computer, etc. can be applied also to a device with many limits of a system resource.

[0049] Furthermore, a 3 time pattern [as opposed to this raster image to this raster image list] and the pattern of subpixel do not need to be known. For this reason, for example, about the image of large range, such as a photograph-of-his-face image downloaded from the server, the subpixel display which improved resolution substantially can be performed and it can display legible.

[0050] In a display according to claim 4, it is $x=1$ and $y=1$. By this configuration, the migration width of face of a pixel becomes small compared with the case where it considers as $x \geq 2$ grade, and crushing, such as the object displayed on a display device, for example, an alphabetic character etc., can be controlled. In a display according to claim 5, it is $x=1$ and $y=1$. By this configuration, it becomes respectively [a pattern on either side] that conflict may arise in a pattern 3 times based on an attention pixel, and a 3 time pattern amendment means can remove conflict by simple processing compared with the case where it considers as $x \geq 2$ grade.

[0051] In a display according to claim 6, it is $n=1$ and $m=1$. By this configuration, the case where a reference pattern becomes the thing excluding the attention pixel from the pixel group of the rectangle of 3×3 , and a reference pattern can take becomes 256 kinds, and simple processing can realize a subpixel display.

[0052] In a display according to claim 7, it is $n=1$ and $m=1$. By this configuration, a reference pattern is the pixel group of the rectangle of 3×3 , the case where a reference pattern can take becomes 512 kinds, and simple processing can realize a subpixel display.

[0053] In an indicating equipment according to claim 8, the raster image which a former image data storage means memorizes is either the bitmapped image which carried out raster expansion of a bit-mapped font and the vector font, or a raster image which is not a font. By this configuration, it indicates by subpixel also with the image of various formats.

[0054] In an indicating equipment according to claim 9, a pattern decision means determines a pattern and the pattern of subpixel 3 times with reference to a reference pattern storage means to memorize the pattern decision rule which determines a pattern and the pattern of subpixel 3 times.

[0055] Since a pattern and the pattern of subpixel are determined 3 times by reference of a reference pattern storage means by this configuration, a high speed can be asked for a pattern and the pattern of subpixel 3 times, and the response of a display can be held good by it.

[0056] In the indicating equipment according to claim 10, the information for pattern matching of a reference pattern is stored in the reference pattern storage means.

[0057] By this configuration, pattern matching can determine a pattern and the pattern of subpixel 3 times.

[0058] In the indicating equipment according to claim 11, the bit string which carried out the bit

expression of the reference pattern, and the information which shows the pattern of the 3 time pattern and subpixel concerning this bit string match, and is stored in the reference pattern storage means.

[0059] By this configuration, a pattern and the pattern of subpixel can be searched at high speed and easily 3 times by the bit string.

[0060] In a display according to claim 12, a pattern decision means determines a pattern and the pattern of subpixel 3 times with reference to the result of an operation of a pattern logical operation means which performs logical operation based on a reference pattern.

[0061] Since a pattern and the pattern of subpixel can be determined 3 times only by logical operation by this configuration even if it has not memorized the reference pattern, a storage region can be saved.

[0062] The gestalt of operation of this invention is explained referring to a drawing below.

(Gestalt 1 of operation) The gestalt 1 of operation of this invention is explained first. Drawing 1 is the block diagram of the indicating equipment in the gestalt 1 of operation of this invention.

[0063] As shown in drawing 1, this indicating equipment possesses the display information input means 1, the display-control means 2, a display device 3, the display-image storage means 4, the former image data constellation storage means 5, the former image data storage means 6, the attention pixel judging means 7, the bit map pattern extract means 8, the pattern decision means 9, the 10 or 3 times many reference pattern storage means [as this] image data storage means 11, and the filtering processing means 12.

[0064] In drawing 1, the display information input means 1 inputs display information. Moreover, the display-control means 2 controls each element of drawing 1, and makes it display on a display device 3 based on the display image which the display-image storage means 4 (VRAM etc.) memorize.

[0065] A display device 3 installs three light emitting devices which emit light in the RGB three primary colors, respectively in fixed sequence, constitutes 1 pixel, installs this pixel in the 1st direction, constitutes one line, prepares two or more these lines in the 2nd direction which intersects perpendicularly in the 1st direction, and comes to constitute the display screen. Specifically, it becomes a color LCD, a color plasma display, etc. from the driver which drives each of these light emitting devices.

[0066] Here, subpixel is explained briefly. Generally, subpixel means the minimum element which constitutes a pixel.

[0067] With the gestalt of this operation, since a display device 3 installs three light emitting devices which emit light in the RGB three primary colors, respectively in fixed sequence and constitutes 1 pixel, subpixel is each element divided equally and obtained three in the 1st direction about 1 pixel.

[0068] Therefore, the subpixel of three RGB will correspond to the light emitting device of three RGB.

[0069] The former image data constellation storage means 5 memorizes a series of former image data like font data. One side or the both sides of a raster font and a vector font is sufficient as this font.

[0070] The former image data storage means 6 stores former image data temporarily. The former image data constellation storage means 5 has memorized raster font data, and when there are directions which display the specific raster font data of the display information input means 1 to the former image data constellation storage means 5, as for the display-control means 2, the raster font data of KARENTO of the former image data constellation storage means 5 is stored in the former image data storage means 6 as it is as former image data.

[0071] Moreover, when there are directions with which the former image data constellation storage means 5 holds vector font data, and displays specific vector font data from the display information input means 1, the display-control means 2 develops that vector font data to a predetermined field, generates a raster image, and stores it in the former image data storage means 6 by using this raster image as a former image.

[0072] Furthermore, when the common raster image which is not memorized by the former image data constellation storage means 5 from the display information input means 1 is inputted, the display-control means 2 develops the inputted raster image to a predetermined field, and stores it in the former image

data storage means 6.

[0073] The attention pixel judging means 7 judges whether with reference to the former image data which the former image data storage means 6 memorizes, it has the pixel value at which the attention pixel was appointed beforehand.

[0074] Since the case where an alphabetic character and a notation are displayed "black" (a background is "white") is mentioned as an example with the gestalt of this operation, this "pixel value appointed beforehand" is a pixel value which shows "black." However, it is not limited to this, either. For example, when displaying an alphabetic character, a notation, etc. in "white" (a background is "black"), this "pixel value appointed beforehand" turns into a pixel value which shows "white."

[0075] Processing in the bit map pattern extract means 8 and the pattern decision means 9 which are shown below is performed only when an attention pixel is judged in the attention pixel judging means 7 to be "black."

[0076] The bit map pattern extract means 8 extracts a bit map pattern from the former image data which the former image data storage means 6 has memorized. The configuration of this bit map pattern is the same as the configuration of the reference pattern contrasted with this.

[0077] Generally, these patterns are defined, as shown in drawing 2. That is, the pixel which attached the central slash is an attention pixel, and these patterns are the things except the pattern of the rectangle which consists of a pixel which encloses an attention pixel, and an attention pixel to an attention pixel, and consist of a pixel of a sum total $(2n+1)(x(2m+1)-1)$ (n and m are the natural number) individual. And when these patterns can take, it is $***** (x(2n+1)(2m+1)-1)$ of 2.

[0078] Here, in order to make the burden of a system light, it is preferably referred to as $n=m=1$. In this case, these patterns become 256 kinds, when it consists of 8 pixels and these patterns can take.

[0079] The pattern decision means 9 searches a reference pattern storage means 10 memorize the reference pattern mentioned above; asks for the reference pattern which suits the bit map pattern which the bit map pattern extract means 8 extracted, and determines the pattern of the subpixel which stands in a row in the 1st direction to the 3-time pattern and attention pixel of an attention pixel according to this reference pattern.

[0080] thus, the pattern of x subpixel (x is an integer) with which the pattern of the subpixel determined stands in a row in the 1st direction to the one side of an attention pixel and the pattern of y subpixel (y is the natural number) which stands in a row in the 1st direction to the other side of an attention pixel — it comes out.

[0081] Moreover, although the 3 time pattern determined by doing in this way expands an attention pixel in the 1st direction 3 times, it will not expand 3 times simply but a reference pattern will be followed like the after-mentioned.

[0082] Below, the case of $n=m=1$ and $x=y=1$ is explained. Since it is $n=m=1$, it is the case where each of a reference pattern and the bit map pattern to extract consists of 8 pixels. Moreover, in this case, in the 1st direction, since it is a longitudinal direction, then $x=y=1$, the pattern of the subpixel which adjoins right and left of an attention pixel with a pattern 3 times is called for.
 [0083] Therefore, in this example, the output of the pattern decision means 9 becomes 5 bits in a 8-pixel input. However, this is an example, in addition can be realized in various modes, such as a 7-bit output ($x=y=2$) of a 24-pixel input ($n=m=2$).

[0084] Next, the above-mentioned point is explained using a drawing. As shown in drawing 3 (a), when a 8-pixel reference pattern is black altogether, as a pattern 50 is shown in drawing 3 (b) 3 times, a main attention pixel is black and also makes black the pixel which adjoins it. Furthermore, as shown in drawing 3 (b) in this case, the right contiguity subpixel pattern 51 is black, and also makes the left contiguity subpixel pattern 52 black.

[0085] On the contrary, as shown in drawing 3 (e), when this 8-pixel reference pattern is white altogether, as a pattern 50 is shown in drawing 3 (f) 3 times, a main attention pixel is black and also makes black the pixel which adjoins it. Furthermore, as shown in drawing 3 (f) in this case, the right

contiguity subpixel pattern 51 is white, and also makes the left contiguity subpixel pattern 52 white.

[0086] About various reference patterns which may exist in such medium, the regulation which determines a pattern and a right-and-left contiguity subpixel pattern 3 times is established beforehand. In this case, although it will become 256 kinds as above-mentioned if all regulations are determined, in consideration of symmetric property or the case where it is displayed in white, it can also respond under fewer regulations.

[0087] In addition, in drawing 3, although the slash is given to the attention pixel, this is attached for convenience, in order to show that an attention pixel is not contained in a 8-pixel reference pattern, and an attention pixel is black in practice.

[0088] The above is one example which determines a pattern and a right-and-left contiguity subpixel pattern 3 times with pattern matching. moreover -- a line seems to be able to draw smoothly (for a jaggy to be) the regulation which determines a 3 time pattern which was illustrated to drawing 3, and a right-and-left contiguity subpixel pattern with a subpixel technique compared with drawing of a pixel unit using the ability to have one 3 times the resolution of this in the 1st direction -- ** -- it creates from a viewpoint to say.

[0089] In addition, the determined 3 time pattern is data assigned to three subpixel which constitutes an attention pixel, and the right-and-left contiguity subpixel pattern for which it asked is data assigned to the subpixel which adjoins right and left of an attention pixel.

[0090] Now, as mentioned above, it asks for a pattern and a right-and-left contiguity subpixel pattern 3 times, and by using the pattern for these five subpixel, in case a subpixel display is performed, it becomes possible to move the pixel in a former image to the right or the left by one subpixel, without changing a pixel value. Such actuation is called a "shift action."

[0091] Drawing 4 is the explanatory view of the shift action of a pixel. An explanatory view in case drawing 4 (a) corresponds to drawing 3 (c) and (d) and a shift action is performed, and drawing 4 (b) are explanatory views in case a shift action is not performed. In addition, in drawing 4, the pixel and subpixel which attached the slash have pointed out that it is black. Moreover, the pixel expressed with the thick line points out an attention pixel.

[0092] As shown in drawing 4 (a), when a pattern and a right-and-left contiguity subpixel pattern are determined 3 times, as an arrow head shows, a 3 time pattern is assigned to three subpixel which constitutes an attention pixel from a 8-pixel reference pattern, and a right-and-left contiguity subpixel pattern is assigned from it to the subpixel which adjoins right and left of an attention pixel.

[0093] Thus, it moves to the right by one subpixel, without the part of the black displayed by the attention pixel in the former image changing magnitude called one pixel (three subpixel), as a result of indicating by subpixel.

[0094] It can be said that it moved to the right by one piece of subpixel, without the pixel of the black in a former image changing a pixel value, as a result of indicating by subpixel notionally, although a pixel did not necessarily move strictly when this was put in another way. Such actuation is a shift action mentioned above.

[0095] On the other hand, from a 8-pixel reference pattern, as shown in drawing 4 (b), when only a pattern is determined 3 times, as an arrow head shows, a 3 time pattern is assigned to three subpixel which constitutes an attention pixel.

[0096] Consequently, in drawing 4 (b), the part of the black displayed by the attention pixel will become two pieces of subpixel, and will become thin. In this case, a situation like drawing 5 (c) mentioned later may occur.

[0097] Drawing 5 is the explanatory view of the effectiveness of the gestalt of this operation. It is an image at the time of drawing 5 (a) asking for a former image, drawing 5 (b) asking for a pattern and a right-and-left contiguity subpixel pattern 3 times, and the image at the time of performing a subpixel display and drawing 5 (c) asking only for a pattern 3 times, and performing a subpixel display. In addition, in drawing 5, the alphabetic character of "A" is displayed into 9x7 pixels.

[0098] If the pixel shown by the arrow head a of drawing 5 (a) and the pixel shown by the arrow head c of drawing 5 (c) are measured, the black part is thin by the image of drawing 5 (c), i.e., the image which performed the subpixel display only in quest of the pattern 3 times, by one piece of subpixel (a case like drawing 4 (b)).

[0099] Consequently, in drawing 5 (c), if an image is seen on the whole, the case where all three subpixel is black, and the case where only two subpixel was black would occur, and the part (part which an arrow head c points out) with the thin line of the black showing the alphabetic character of "A" will have occurred. That is, dispersion in concentration has arisen in the image.

[0100] On the other hand, a comparison of the pixel shown by the arrow head a of drawing 5 (a) and the pixel shown by the arrow head b of drawing 5 (b) is moving the black pixel to the right by one piece of subpixel by the image which performed the subpixel display in quest of the image of drawing 5 (b), i.e., a 3 time pattern, and the right-and-left contiguity subpixel pattern, without changing a pixel value (a shift action like drawing 4 (a)).

[0101] Thus, as a result of asking for a pattern and a right-and-left contiguity subpixel pattern 3 times and performing a shift action, in drawing 5 (b), a part with the thin line of the black showing the alphabetic character of "A" does not occur, and dispersion in concentration has not arisen in an image.

[0102] For this reason, when performing a subpixel display in quest of a pattern and a right-and-left contiguity subpixel pattern 3 times, as compared with the case (drawing 5 (c)) where a subpixel display is performed only in quest of (drawing 5 (b)) and a 3 time pattern, the alphabetic character of "A" will be displayed clearly and smoothly.

[0103] Now, in performing a subpixel display, the regulation which determines a pattern and a right-and-left contiguity subpixel pattern 3 times is defined as mentioned above from a viewpoint which a line can draw smoothly compared with drawing of the pixel unit in a former image.

[0104] Therefore, to all the bit map patterns that the bit map pattern extract means 8 extracted, the regulation which determines a pattern and a right-and-left contiguity subpixel pattern 3 times is not defined so that a shift action may be performed. that is, as for the regulation which determines a pattern and a right-and-left contiguity subpixel pattern 3 times, a shift action is performed when the smoothness of a line is spoiled as a result of a shift action -- as -- it is not set.

[0105] For example, compared with drawing of the pixel unit in a former image, the regulation which, as for the following case, performs a shift action is not defined from a viewpoint which a line can draw smoothly.

[0106] Drawing 6 is an explanatory view in case a shift action is not performed. Drawing 6 (a) shows the image which indicated by subpixel when assuming that a former image in case a shift action is not performed, and drawing 6 (b) performed the shift action.

[0107] When the image shown in drawing 6 (a) is a former image, it is assumed that the regulation which determines a pattern and a right-and-left contiguity subpixel pattern 3 times was defined so that a shift action may be performed.

[0108] If a subpixel display is performed according to such a regulation, as shown in drawing 6 (b), white subpixel will exist between black subpixel and black subpixel, and fragmentation will occur. Therefore, in order to prevent generating of fragmentation and to realize a smooth display in this case, the regulation which determines a pattern and a right-and-left contiguity subpixel pattern the 3 following times is defined.

[0109] Drawing 7 is instantiation drawing of the regulation which determines the 3 time pattern which does not perform a shift action, and a right-and-left contiguity subpixel pattern.

[0110] As for the case of drawing 7 (a), a 8-pixel reference pattern defines a pattern and a right-and-left contiguity subpixel pattern like drawing 7 (b) 3 times. As for the case of drawing 7 (c), a 8-pixel reference pattern defines a pattern and a right-and-left contiguity subpixel pattern like drawing 7 (d) 3 times. As for the case of drawing 7 (e), a 8-pixel reference pattern defines a pattern and a right-and-left contiguity subpixel pattern like drawing 7 (f) 3 times.

[0111] Drawing 8 is drawing showing the image which indicated by subpixel by using the image of drawing 6 (a) as a former image according to the regulation of drawing 7.

[0112] In drawing 8, although line breadth changes as compared with a former image, fragmentation is not generated like drawing 6 (b). Therefore, as for the image of drawing 8, the smooth display is realized as compared with the image of drawing 6 (b).

[0113] In addition, like the former image of drawing 6 (a), when the slanting line is displayed, even if line breadth changes like drawing 8, change of line breadth is not noticeable with a subpixel display, it is sensed to human being's eye that it became smooth, and a good result can be rather obtained to it.

[0114] Moreover, for example, drawing 3 (a), (b), (e), and (f) are the regulations under which a shift action is not performed.

[0115] Now, the bit map pattern extract means 8 and the pattern decision means 9 perform the above-mentioned processing only about a black attention pixel as mentioned above. The effectiveness in this case is explained using drawing 5 (a).

[0116] By the former image of drawing 5 (a), 13 pixels are black among all 63 pixels. Therefore, with the gestalt of this operation, since the above-mentioned processing is performed about the pixel of 13 black, as compared with the case where the above-mentioned processing is performed to all pixels, the cutback of 79% of throughput is realizable.

[0117] Now, above, it is asking for the pattern and the right-and-left contiguity subpixel pattern 3 times. In this case, the case where a pixel moves to the left by one piece of subpixel, and a pixel may move a shift action to the right by one piece of subpixel. This point is explained using a drawing.

[0118] Drawing 9 is the explanatory view of the mode of the shift action in the case of asking for a pattern and a right-and-left contiguity subpixel pattern 3 times. In addition, in drawing 9, the rectangle expressed with the thick line points out an attention pixel.

[0119] Drawing 9 (a) shows five subpixel to which a pattern and a right-and-left contiguity subpixel pattern are assigned 3 times, and drawing 9 (b) shows the case where, as for drawing 9 (d), a black pixel moves to the right by one piece of subpixel, when a black pixel moves to the left by one piece of subpixel, and a black pixel does not move drawing 9 (c).

[0120] Thus, when asking for a pattern and a right-and-left contiguity subpixel pattern 3 times, it becomes possible to move a black pixel to right and left by one piece of subpixel, without changing a pixel value.

[0121] However, this is an example, and as mentioned above, it is possible to ask for a 3 time pattern and not only a right-and-left contiguity subpixel pattern but a 3 time pattern, the pattern of x subpixel (x is an integer) which stands in a row in the 1st direction to the one side of an attention pixel, and the pattern of y subpixel (y is the natural number) which stands in a row in the 1st direction to the other side of an attention pixel, and to also make a subpixel display perform.

[0122] Therefore, the mode of a shift action also differs from drawing 9 in this case. The case of x= 1 and y= 2 is mentioned as an example, and this point is explained.

[0123] Drawing 10 is the explanatory view of the mode of the shift action in the case of asking for a 3 time pattern, the pattern of one subpixel which stands in a row in the 1st direction to the left-hand side of an attention pixel, and the pattern of two subpixel which stands in a row in the 1st direction to the right-hand side of an attention pixel. In addition, in drawing 10, the rectangle expressed with the thick line points out an attention pixel.

[0124] Drawing 10 (a) shows six subpixel to which a pattern and a subpixel pattern are assigned 3 times.

[0125] That is, a 3 time pattern is assigned to three subpixel which constitutes an attention pixel, the pattern of one subpixel which stands in a row in the 1st direction to the left-hand side of an attention pixel is assigned to one subpixel which stands in a row on the left of an attention pixel, and the pattern of two subpixel which stands in a row in the 1st direction to the right-hand side of an attention pixel is assigned to two subpixel which stands in a row on the right of an attention pixel.

[0126] And it is *****, when a black pixel moves to the left by one piece of subpixel as a mode of a

shift action in this case (drawing 10 (b)), a black pixel moves to the right by one piece of subpixel (drawing 10 (d)) and a black pixel moves to the right by two pieces of subpixel (drawing 10 (e)). In addition, drawing 10 (c) shows the case where a black pixel does not move.

[0127] Thus, even if "x" differs from "y", the shift action will be possible and, so, will do the effectiveness as drawing 5 that it is the same such even case.

[0128] In addition, by changing "x" and "y", the shift action of various modes can be realized and the same effectiveness as drawing 5 can be demonstrated.

[0129] Therefore, not only when moving a pixel to right and left by one piece of subpixel, but making it move to right and left by k pieces of subpixel (for k to be the natural number) within the limit of the value of "x" and "y" is included in the "shift action" of the gestalt of this operation.

[0130] Moreover, either "x" or "y" is possible for a shift action only by the shift action to a uni directional (left or right) not being made in the case of "0", either, and the same effectiveness as drawing 5 can be demonstrated.

[0131] In addition, to all the bit map patterns that the bit map pattern extract means 8 extracted, the regulation which determines the pattern of the subpixel (x pieces, y pieces) which stands in a row in the 1st direction to the 3 time pattern and attention pixel of an attention pixel is not defined so that a shift action may be performed.

[0132] As mentioned above, in performing a subpixel display, this regulation is defined from a viewpoint which a line can draw smoothly compared with drawing of the pixel unit in a former image.

[0133] Now, in indicating by subpixel, by ****, the shift action which makes it move to right and left by k pieces of subpixel (for k to be the natural number) was explained; without changing a pixel value for the "pixel" of the black in a former image.

[0134] between the images in which this indicated by subpixel with the former image -- the line breadth (an alphabetic character, a notation, graphic forms, or those combination) of an object -- being the same (one black pixel) -- it is because it is carrying out.

[0135] However, about the former image with which the shift action is possible with an image not only a case such but, and considers line breadth of an object as one black pixel, in case a subpixel display is performed, the line breadth of an object can be set as arbitration. An example is given and this point is explained.

[0136] The former image which considers line breadth of an alphabetic character as one black pixel is considered. And in the case of a subpixel display, the case where line breadth of an alphabetic character is made five black subpixel is considered.

[0137] In this case, it considers that the line breadth displayed by one black pixel in a former image is a part for Kurobe which consists of five subpixel, and the shift action which makes it move to right and left by k pieces of subpixel (for k to be the natural number) will be performed, without changing the magnitude for Kurobe which consists of this five subpixel.

[0138] Therefore, the "shift action" of the gestalt of this operation can be said to be making it move to right and left by k pieces of subpixel (for k to be the natural number), without changing magnitude called j subpixel in the line part which consists of j subpixel, when considering line breadth of an object as j subpixel (j is the natural number) in case the former image by which the object is expressed is indicated by subpixel.

[0139] Although subpixel will not necessarily move strictly if this is put in another way, notionally [in case the "shift action" of the gestalt of this operation indicates the former image by which the object is expressed by subpixel, when it considers line breadth of an object as j subpixel (j is the natural number)] j subpixel which displays the line can be said to be making it move to right and left by k pieces of subpixel (for k to be the natural number), without changing the value of all j subpixel.

[0140] It hits performing a subpixel display, as a result of performing such a shift action, and a smoother display can be realized compared with the case where the line breadth of the object of a former image is expanded or reduced simply.

[0141] They are the following cases when expanding the line breadth of the object of a former image simply. The former image which considers line breadth of an alphabetic character as one black pixel is considered. And in the case of a subpixel display, the case where line breadth of an alphabetic character is made five black subpixel is considered.

[0142] In this case, three the subpixel corresponding to the pixel of the black of a former image and the subpixel of right and left are made into black.

[0143] They are the following cases when reducing the line breadth of the object of a former image simply. The former image which considers line breadth of an alphabetic character as one black pixel is considered. And in the case of a subpixel display, the case where line breadth of an alphabetic character is made two black subpixel is considered.

[0144] In this case, subpixel of a center and the left is made into black among three subpixel corresponding to the pixel of the black of a former image.

[0145] In addition, the regulation which determines the pattern of the subpixel (x pieces, y pieces) which stands [as opposed to / even when it changes the line breadth of an object, so that a shift action may be performed between a former image and the image which indicated by subpixel to all the bit map patterns that the bit map pattern extract means 8 extracted / the 3 time pattern and attention pixel of an attention pixel] in a row in the 1st direction is not defined.

[0146] As mentioned above, in performing a subpixel display, this regulation is defined from a viewpoint which a line can draw smoothly compared with drawing of the pixel unit in a former image. therefore, as for the regulation which determines a pattern and a right-and-left contiguity subpixel pattern 3 times, a shift action is performed when the smoothness of a line is spoiled as a result of a shift action -- as -- it is not set.

[0147] Now, as $x=y=1$, it asks for a pattern and a right-and-left contiguity subpixel pattern 3 times, and the effectiveness in the case of making the output of the pattern decision means 9 into 5 bits is explained below, referring to a drawing.

[0148] Drawing 11 is the explanatory view of the effectiveness at the time of being referred to as $x=y=1$.

In addition, in drawing 11, "the reverse of V characters" is displayed into 3x5 pixels.

[0149] Drawing 11 (a) is the case where ask for a 3 time pattern, the pattern of two subpixel which stands in a row in the 1st direction to the left-hand side of an attention pixel, and the pattern of two subpixel which stands in a row in the 1st direction to the right-hand side of an attention pixel as $x=y=2$, and the output of the pattern decision means 9 is made into 7 bits.

[0150] In this case, in drawing 11 (a), the pixel of the black located in two-line two trains moves to the right by two subpixel, and the pixel of the black located in two-line four trains is moving to the left by two subpixel.

[0151] Consequently, in drawing 11 (a), crushing has occurred to the alphabetic character. Thus, when referred to as $x=y=2$, crushing may occur to an alphabetic character as a result of a shift action.

[0152] On the other hand, drawing 11 (b) is the case where ask for a pattern and a right-and-left contiguity subpixel pattern 3 times, and the output of the pattern decision means 9 is made into 5 bits as $x=y=1$.

[0153] In this case, as shown in drawing 11 (b), crushing does not occur to an alphabetic character. Thus, by being referred to as $x=y=1$, when a shift action is performed, generating of crushing of an alphabetic character can be controlled. It is because migration of the pixel by the shift action is only one subpixel.

[0154] Now, the case of $n=m=1$ and $x=y=1$ is mentioned as an example and it returns to explanation of each configuration of drawing 1. A reference pattern as shown in drawing 3 or drawing 7, and a 3 time pattern and a right-and-left contiguity subpixel pattern relate, and are memorized by the reference pattern storage means 10.

[0155] As mentioned above, with reference to the reference pattern storage means 10, the pattern decision means 9 uses pattern matching like drawing 3 or drawing 7, and determines a pattern and a

right-and-left contiguity subpixel pattern 3 times.

[0156] The 3 time image data storage means 11 memorizes the 3 time image data (data assigned to three subpixel (light emitting device) which constitutes 1 pixel) containing the 3 time pattern which the pattern decision means 9 determines, and a right-and-left contiguity subpixel pattern by one former image.

[0157] The filtering processing means 12 performs filtering processing which was stated by the term of a Prior art to the 3 time image which the image data storage means 11 memorizes 3 times, and stores in the display image storage means 4 the image obtained by this processing.

[0158] Now, although the above explained an example which determines a pattern and a right-and-left contiguity subpixel pattern 3 times with pattern matching like drawing 3, a pattern can be expressed in a bit and can also be transformed as follows.

[0159] That is, if black shall be expressed by "0" and white shall be expressed by "1" as shown in drawing 12, 8-pixel black and white can be expressed by the bit string (8 figures) of "0" or "1" in order from the 8-pixel upper left of a reference pattern to the lower right.

[0160] And as shown in drawing 3 (a), when a 8-pixel reference pattern is black altogether, it can express by the bit string "00000000" and the 3 time pattern to this and a right-and-left contiguity subpixel pattern are set to "00000" (upper case of drawing 12).

[0161] On the contrary, as shown in drawing 3 (e), when this 8-pixel reference pattern is white altogether, it can express by the bit string "11111111" and the 3 time pattern to this and a right-and-left contiguity subpixel pattern are set to "10001" (lower berth of drawing 12).

[0162] The regulation which determines a pattern and a right-and-left contiguity subpixel pattern 3 times is beforehand established like [case / where it expresses by such bit string] **** about various patterns which may exist in the medium of a bit string "00000000" and a bit string "11111111." In this case, although it will become 256 kinds as above-mentioned if all regulations are determined, in consideration of symmetric property or the case where it is displayed in white, a part of regulation can be omitted and it can also respond under regulations fewer than 256 kinds.

[0163] And by making a bit string into an index, by the storage structure of an array or other common knowledge, the regulation by these bits is associated and is stored in the reference pattern storage means 10. Then, shortly after lengthening the reference pattern storage means 10 by the index, the 3 time pattern for which it asks, and a right-and-left contiguity subpixel pattern can be obtained.

[0164] Of course, even if it replaces indicating the bit string of 8 figures by the hexadecimal etc. by other equivalent styles, it does not interfere.

[0165] As mentioned above, when the regulation which determines a pattern and a right-and-left contiguity subpixel pattern 3 times is expressed in a bit, the bit string which expressed a reference pattern like drawing 12 in the bit for the reference pattern storage means 10, and a 3 time pattern and a right-and-left contiguity subpixel pattern relate, and is memorized.

[0166] In this case, with reference to the reference pattern storage means 10, the pattern decision means 9 uses retrieval by index like drawing 12, and determines a pattern and a right-and-left contiguity subpixel pattern 3 times.

[0167] Now, the flow of processing is explained using the display of drawing 1, mentioning the case of $n=m=1$ and $x=y=1$ as an example and referring to drawing 13 next. First, display information is inputted into the display information input means 1 in step 1.

[0168] When there are directions which display the specific raster font data of the display information input means 1 to the former image data constellation storage means 5, as for the display-control means 2, the raster font data of KARENTO of the former image data constellation storage means 5 is stored in the former image data storage means 6 as it is as former image data.

[0169] Moreover, when there are directions which display specific vector font data from the display information input means 1, the display-control means 2 develops that vector font data to a predetermined field, generates a raster image, and stores it in the former image data storage means 6 by

using this raster image as a former image.

[0170] Furthermore, when the common raster image which is not memorized by the former image data constellation storage means 5 from the display information input means 1 is inputted, the display-control means 2 develops the inputted raster image to a predetermined field, and stores it in the former image data storage means 6 (step 2).

[0171] Next, in step 3, the display-control means 2 initializes a 3 time image data storage means 11 to store the result of the pattern decision means 9. When an attention pixel is black (ON) and processing which determines a pattern and a right-and-left contiguity subpixel pattern 3 times is specifically performed, all the image data storage areas of the image data storage means 11 are initialized to white data (OFF) 3 times. This means initializing the 3 time image data for one former image (data assigned to all the subpixel for one dimension image) to white data (OFF).

[0172] In addition, when an attention pixel is white (OFF) and processing which determines a pattern and a right-and-left contiguity subpixel pattern 3 times is performed, all the image data storage areas of the image data storage means 11 are initialized to black data (ON) 3 times.

[0173] Below, when an attention pixel is black (ON), the case where processing which determines a pattern and a right-and-left contiguity subpixel pattern 3 times is performed is mentioned as an example, and is explained.

[0174] Next, the display-control means 2 initializes the attention pixel of the attention pixel judging means 7 to an upper left initial position at step 4.

[0175] Next, at step 5, the display-control means 2 extracts an attention pixel to the attention pixel judging means 7, and it orders judging whether it is black.

[0176] Then, the attention pixel judging means 7 extracts an attention pixel from the former image data of the former image data storage means 6.

[0177] Next, it judges whether the attention pixel judging means 7 performs processing which determines a pattern and a right-and-left contiguity subpixel pattern 3 times to the extracted attention pixel at step 6. That is, the attention pixel which extracted the attention pixel judging means 7 judges whether it is black (ON).

[0178] And when an attention pixel is judged to be black (ON), it progresses to step 7. In this case, the display-control means 2 orders the extract of the 8-pixel bit map pattern around an attention pixel to the bit map pattern extract means 8.

[0179] On the other hand, when an attention pixel is judged to be white (OFF), it progresses to step 11. And if the display-control means 2 are not all attention pixel termination (step 11), they will update an attention pixel (step 12).

[0180] Now, at step 7, from the former image data of the former image data storage means 6, the bit map pattern extract means 8 extracts the 8-pixel bit map pattern around an attention pixel, and returns it to the display-control means 2. For example, when the slash section of drawing 14 (a) is the present attention pixel, the bit map pattern extract means 8 extracts the 8-pixel bit map pattern around the attention pixel except an attention pixel as shown in drawing 14 (b).

[0181] In addition, in drawing 14 (a) and (b), although the slash is given to the attention pixel, this is for the facilities of explanation and is black in practice.

[0182] The display-control means 2 will order the decision of the 3 time pattern and right-and-left contiguity subpixel pattern which suit delivery and this bit map pattern to the pattern decision means 9 in this, if a bit map pattern is received from the bit map pattern extract means 8.

[0183] Then, the pattern decision means 9 asks for the reference pattern which suits the bit map pattern which searched the 3 time pattern and the right-and-left contiguity subpixel pattern decision rule of the reference pattern storage means 10 (step 8), and was received, asks for the 3 time pattern corresponding to the reference pattern for which it asked, and a right-and-left contiguity subpixel pattern (step 9), and stores them in the image data-storage means 11 3 times (step 10).

[0184] For example, the pattern decision means 9 asks for the reference pattern which is in agreement

with the bit map pattern of drawing 14 (b), determines the 3 time pattern shown in drawing 14 (c), and a right-and-left contiguity subpixel pattern to it, and stores them in the image data storage means 11 3 times.

[0185] The display-control means 2 performs processing from step 5 to step 10 repeatedly until the processing about all attention pixels is completed, updating an attention pixel (step 12) (step 11). And the information for which it is equivalent to the image shown in drawing 15 when the pattern decision means 9 stores a pattern and a right-and-left contiguity subpixel pattern in order 3 times will be stored in the image data storage means 11 3 times.

[0186] After this repeat processing is completed, the display-control means 2 makes filtering processing carry out to the filtering processing means 12 to the 3 time image data of the image data storage means 11 3 times (step 13), and the filtering processing means 12 stores the image after processing to the display image storage means 4 (step 14).

[0187] And the display-control means 2 assigns image data to three light emitting devices which constitute 1 pixel of a display device 3 these 3 times, and makes it display on a display device 3 based on the display image stored in the display-image storage means 4 (step 15).

[0188] In the example of drawing 15, it will be displayed like drawing 16. here, if drawing 16 is compared with drawing 14 (a), it will be understood that there are few jaggies, and they are markedly alike and the direction of drawing 16 serves as a legible display.

[0189] And if the display-control means 2 is not display termination (step 16), it will return processing to step 1.

[0190] Now, the pattern decision means 9 explains below an example of a concrete procedure which determines a pattern and a right-and-left contiguity subpixel pattern 3 times with pattern matching as $n=m=1$ and $x=y=1$ using a drawing.

[0191] Drawing 17 is instantiation drawing of the concrete procedure in which the pattern decision means 9 determines a pattern and a right-and-left contiguity subpixel pattern 3 times with pattern matching.

[0192] If the slash section is made into an attention pixel as shown in drawing 17, the pattern decision means 9 will scan eight pixels p0-p7 around an attention pixel, and will generate the address. In addition, that the bit map pattern extract means 8 extracts is illustrating the expedient top of explanation, and the attention pixel, although it is the 8-pixel bit map pattern of the perimeter of an attention pixel.

[0193] The pattern decision means 9 uses as a pattern and a right-and-left contiguity subpixel pattern the data (5 bits) of the table corresponding to the address which searched the table of the reference pattern storage means 10, and was generated 3 times.

[0194] Thus, the 3 time pattern and right-and-left contiguity subpixel pattern which were determined are assigned to three subpixel which constitutes an attention pixel, and the right-and-left contiguity subpixel of an attention pixel after filtering processing is performed by the filtering processing means 12.

[0195] Here, the above-mentioned table which the reference pattern storage means 10 has is explained. Since it is referred to as $n=m=1$, the address in which the class of bit map pattern in which it is extracted with the bit map pattern extract means 8, and deals becomes 256 kinds (8th power passage of 2), and it is generated and deals also becomes 256 kinds.

[0196] Therefore, the reference pattern storage means 10 has 256 tables corresponding to 256 kinds of this address.

[0197] According to the pattern and the right-and-left contiguity subpixel pattern decision rule, the pattern and the right-and-left contiguity subpixel pattern (5-bit data) are stored in each table 3 times 3 times.

[0198] Now, as drawing 9 and drawing 10 explained, in the gestalt of this operation, a pixel can be moved in the 1st direction within the limit of the value of "x" and "y" by the migration width of face for one subpixel, without changing a pixel value.

[0199] For this reason, in indicating by subpixel, dispersion in the concentration of the output image

resulting from the line breadth showing objects (an alphabetic character, a notation, graphic forms, or those combination) changing can be controlled. Consequently, a high quality subpixel display is realizable (drawing 5).

[0200] Moreover, in step 6 of drawing 13 , as for the attention pixel judging means 7, an attention pixel judges whether it is black. And the pattern decision means 9 performs processing which determines a pattern and the pattern of subpixel 3 times, only when an attention pixel is black.

[0201] For this reason, as compared with the case where these are determined to all attention pixels, the whole throughput is mitigable. Consequently, the burden of a system can be mitigated and a cellular phone, a mobile computer, etc. can be applied also to a device with many limits of a system resource.

[0202] And in order for the pattern decision means 9 to determine a pattern and the pattern of subpixel dynamically 3 times about a black attention pixel in step 7 of drawing 13 - step 9, it is not necessary to hold a pattern and the pattern of subpixel statically 3 times. Moreover, in order to obtain a pattern by initialization of step 3 of drawing 13 3 times about a white attention pixel, it is not necessary to hold statically also about this.

[0203] Therefore, compared with the case where a pattern and the pattern of subpixel are stored statically 3 times, the burden of a system is mitigable. thereby -- the above-mentioned effectiveness and a device with many [conjointly] limits of a system resource -- receiving -- more -- application -- it becomes easy.

[0204] Furthermore, a 3 time pattern [as opposed to this raster image to a raster image list] and the pattern of subpixel do not need to be known. For this reason, for example, about the image of large range, such as a photograph-of-his-face image downloaded from the server, the subpixel display which improved resolution substantially can be performed and it can display legible.

[0205] (Gestalt 2 of operation) Next, the gestalt 2 of operation of this invention is explained. About the configuration of the gestalt 2 of operation, only a point of difference with the gestalt 1 of operation is explained. Drawing 18 is the block diagram of the indicating equipment in the gestalt 2 of operation of this invention.

[0206] With the gestalt of this operation, unlike the gestalt 1 of operation, a pattern decision rule is not memorized 3 times; but it asks by logical operation processing. That is, as shown in drawing 18 ; to drawing 1 R> 1, it replaced with the reference pattern storage means 10, and the pattern logical operation means 13 is established.

[0207] Hereafter, as $n=m=1$ and $x=y=1$, when an attention pixel is black, the case where processing which determines a pattern and a right-and-left contiguity subpixel pattern 3 times is performed is mentioned as an example, and is explained.

[0208] The logical operation of the pattern logical operation means 13 is explained referring to drawing 19 .

[0209] The pattern logical operation means 13 consists of functions which perform conditional judgment after drawing 19 (b), and return the bit value of 5 figures which determines a pattern and a right-and-left contiguity subpixel pattern 3 times as a return value to the decision result about 8 pixels except an attention pixel like drawing 19 (a) from a main attention pixel (0 0) and the pixel (a total of three x3 pixels) which adjoins this.

[0210] Here, after drawing 19 (b), "*" means that monochrome any are sufficient, and is set to black =1 and white =0. Moreover, although an attention pixel is black, the slash is attached for the facilities of explanation.

[0211] For example, a return value will be set to "11111", if the pixel in right and left of an attention pixel is black as shown in drawing 19 (b).

[0212] Moreover, a return value will be set to "00111", if the pixel which has upwards the pixel which has the pixel which has upwards the pixel which exists right above in slight white and a slight left slanting on the basis of an attention pixel in white and the left in white and right under in slight black and a slight right slanting is black as shown in drawing 19 (c).

[0213] In addition, the logic which can carry out data processing is prepared in the pattern logical operation means 13 like drawing 19 (d), (e), and --.

[0214] Thereby, also in the gestalt 2 of operation, it will be understood like the gestalt 1 of operation that a pattern and a right-and-left contiguity subpixel pattern can be determined 3 times. Therefore, since a shift action is performed like the gestalt 1 of operation, the same effectiveness as the gestalt 1 of operation is done so.

[0215] Moreover, it can be made easy to mount in a device with a severe limit of a storage region, since it does not depend on a storage region but is based on data processing with the gestalt 2 of operation.

[0216] Next, the flow of processing is explained using the display of drawing 18, referring to drawing 20. However, it explains focusing on different processing from drawing 13. That is, in drawing 20, it replaced with step 8 (retrieval of the reference pattern storage means 10) of drawing 13, and a different step 8 (pattern logical operation) from this is formed.

[0217] A pattern decision means 9 by which the decision of a pattern and a right-and-left contiguity subpixel pattern was able to be ordered 3 times makes logical operation which was mentioned above for the pattern logical operation means 13 perform from the display-control means 2 at step 8 in drawing 20.

[0218] And the pattern decision means 9 acquires the return value at step 9 (step 9). It means that the pattern and the right-and-left contiguity subpixel pattern were determined 3 times by this.

[0219] Next, the pattern decision means 9 stores the 3 time pattern by this return value, and a right-and-left contiguity subpixel pattern in the image data storage means 11 3 times at step 10.

[0220] Other processings are the same as that of drawing 13. In addition, it cannot be overemphasized that the configuration which combined the gestalt 1 of operation and the gestalt 2 of operation is also included by this invention. For example, two steps of processings which consist of processing by the reference pattern storage means 10 and processing by the pattern logical operation means 13 may be performed. Under the present circumstances, after the point of processing by the reference pattern storage means 10 and processing by the pattern logical operation means 13 is not asked.

[0221] (Gestalt 3 of operation) The gestalt 3 of operation of this invention is explained.

[0222] Drawing 21 is the block diagram of the indicating equipment in the gestalt 3 of operation of this invention.

[0223] As shown in drawing 21, this indicating equipment possesses the display information input means 1, the display-control means 2, a display device 3, the display-image storage means 4, the former image data constellation storage means 5, the former image data storage means 6, the bit map pattern extract means 14, the pattern decision means 15, the 17 or 3 times many 16 or 3 times as many reference pattern storage means [as this] pattern amendment means [as this] image data storage means 11, and the filtering processing means 12. In addition, about the same part as drawing 1, the same sign is attached and explanation is omitted suitably.

[0224] The bit map pattern extract means 14 of drawing 21 extracts a bit map pattern from the former image data which the former image data storage means 6 has memorized. The configuration of this bit map pattern is the same as the configuration of the reference pattern contrasted with this.

[0225] Generally, these patterns are defined, as shown in drawing 22. That is, the pixel which attached the central slash is an attention pixel, and these patterns consist of a pixel of a sum total $(2n+1) \times (2m+1)$ (n and m are the natural number) individual which consists of an attention pixel and a pixel which encloses this attention pixel. And when these patterns can take, it is $2^{(2n+1)(2m+1)}$. This point and these patterns differ from drawing 2 of the gestalt 1 of the operation which is a sum total $(2n+1) \times (2m+1) - 1$ (n and m are the natural number) individual greatly.

[0226] Here, in order to make the burden of a system light, it is preferably referred to as $n=m=1$. In this case, these patterns become 512 kinds, when it consists of 9 pixels and these patterns can take.

[0227] The pattern decision means 15 searches a reference pattern storage means 16 memorize the reference pattern mentioned above, asks for the reference pattern which suits the bit map pattern

which the bit map pattern extract means 14 extracted, and determines the pattern of the subpixel which stands in a row in the 1st direction to the 3 time pattern and attention pixel of an attention pixel according to this reference pattern.

[0228] thus, the pattern of x subpixel (x is an integer) with which the pattern of the subpixel determined stands in a row in the 1st direction to the one side of an attention pixel and the pattern of y subpixel (y is the natural number) which stands in a row in the 1st direction to the other side of an attention pixel – it comes out.

[0229] Moreover, although the 3 time pattern determined by doing in this way expands an attention pixel in the 1st direction 3 times, it will not expand 3 times simply but a reference pattern will be followed like the after-mentioned.

[0230] Below, the case of $n=m=1$ and $x=y=1$ is explained. Since it is $n=m=1$, it is the case where each of a reference pattern and the bit map pattern to extract consists of 9 pixels. Moreover, it will ask for the pattern of the subpixel which adjoins right and left of an attention pixel with a pattern 3 times in the 1st direction since it is a longitudinal direction, then $x=y=1$ in this case.

[0231] Therefore, in this example, the output of the pattern decision means 15 becomes 5 bits in a 9-pixel input. However, this is an example, in addition can be realized in various modes, such as a 7-bit output ($x=y=2$) of a 25-pixel input ($n=m=2$).

[0232] Next, the above-mentioned point is explained using a drawing.

[0233] As shown in drawing 23 (a), when a 9-pixel reference pattern is black altogether, as a pattern 60 is shown in drawing 23 (b) 3 times, a main attention pixel is black and also makes black all the pixels that adjoin it. Furthermore, as shown in drawing 23 (b) in this case, the left contiguity subpixel pattern 62 is black; and also makes the right contiguity subpixel pattern 61 black.

[0234] On the contrary, as shown in drawing 23 R> 3 (e), when this 9-pixel reference pattern is white altogether, as a pattern 60 is shown in drawing 23 (f) 3 times, a main attention pixel is white and also makes white the pixel which adjoins it. Furthermore, as shown in drawing 23 (f) in this case, the left contiguity subpixel pattern 62 is white, and also makes the right contiguity subpixel pattern 61 white.

[0235] About various reference patterns which may exist in such medium, the regulation which determines a pattern and a right-and-left contiguity subpixel pattern 3 times is established beforehand. In this case, although it will become 512 kinds as above-mentioned if all regulations are determined, in consideration of symmetric property or the case where it is displayed in white, it can also respond under fewer regulations.

[0236] The above is one example which determines a pattern and a right-and-left contiguity subpixel pattern 3 times with pattern matching. moreover -- a line seems to be able to draw smoothly (for a jaggy to be) the regulation which determines a 3 time pattern which was illustrated to drawing 23 , and a right-and-left contiguity subpixel pattern with a subpixel technique compared with drawing of a pixel unit using the ability to have one 3 times the resolution of this in the 1st direction -- ** -- it creates from a viewpoint to say.

[0237] In addition, the determined 3 time pattern is data assigned to three subpixel which constitutes an attention pixel, and the right-and-left contiguity subpixel pattern for which it asked is data assigned to the subpixel which adjoins right and left of an attention pixel.

[0238] Now, as mentioned above, it asks for a pattern and a right-and-left contiguity subpixel pattern 3 times, and it becomes possible to move a pixel to the right or the left by one subpixel by using the pattern for these five subpixel, without changing a pixel value.

[0239] Although such actuation is called a "shift action", this semantics is the same as the gestalt 1 of operation. Therefore, also with the gestalt of this operation, since a shift action is performed, the same effectiveness as the gestalt 1 of operation as shown in drawing 5 is done so.

[0240] However, with the gestalt of this operation, unlike the gestalt 1 of operation, an attention pixel performs processing which determines a pattern and a right-and-left contiguity subpixel pattern 3 times to all attention pixels rather than performs processing which determines a pattern and a right-and-left

contiguity subpixel pattern 3 times only in the case of black.

[0241] For this reason, conflict of a pattern may arise about the overlapping part between the 3 time pattern for which it asked from a certain pixel and a right-and-left contiguity subpixel pattern, and the 3 time pattern and right-and-left contiguity subpixel pattern for which it asked from the pixel which adjoins that pixel.

[0242] In order to cancel this conflict, as shown in drawing 21 , the pattern amendment means 17 is established 3 times. This point is explained in detail using a drawing.

[0243] Drawing 24 is symbol description drawing of the 3 time pattern amendment means 17. In addition, in drawing 24 , the pixel and subpixel which attached the slash mean that it is black.

[0244] As shown in drawing 24 , in a former image, the pixel 20 of adjacent black and the white pixel 30 are considered.

[0245] Now, when you make a pixel 20 into an attention pixel, suppose that the pattern and the right-and-left contiguity subpixel pattern were determined 3 times like the subpixel pixels 21-25. Moreover, when you make a pixel 30 into an attention pixel, suppose that the pattern and the right-and-left contiguity subpixel pattern were determined 3 times like the subpixel pixels 31-35.

[0246] In this case, it is the pattern of the same black and is satisfactory at the overlapping subpixel 24 and subpixel 31.

[0247] However, in the overlapping subpixel 25 and subpixel 32, patterns differ in black and white, conflict arises, and it is a problem. Therefore, it needs to be decided in this case that they will be either black or white, and it is necessary to remove this conflict.

[0248] Then, the 3 time pattern amendment means 17 removes this conflict, and amends to a pattern 3 suitable times.

[0249] An example of the amendment technique in this case is explained. The 3 time pattern amendment means 17 evaluates a pattern by whether the "shift action" is performed in the 3 time pattern which the pattern decision means 15 determined, and the right-and-left contiguity subpixel pattern, and removes conflict by it.

[0250] In the example of drawing 24 , the shift action to the right of a pixel 20 is performed in the 3 time pattern which determined the pixel 20 as an attention pixel, and the right-and-left contiguity subpixel pattern (subpixel 21-25). On the other hand, the shift action is not performed in the 3 time pattern which determined the pixel 30 as an attention pixel, and the right-and-left contiguity subpixel pattern (subpixel 31-35).

[0251] Therefore, the 3 time pattern amendment means 17 gives priority to the 3 time pattern which obtained the pixel 20 to which the shift action was performed as an attention pixel, and a right-and-left contiguity subpixel pattern, i.e., the pattern of subpixel 21-25.

[0252] Therefore, by the subpixel 25 which conflict has generated, and subpixel 32, priority is given to the pattern of the black of the subpixel 25 which obtained the pixel 20 as an attention pixel, and the pattern of the subpixel 36 at the left end of a pixel 30 is determined as black. In subpixel 33 and 34, since there is no conflict, the pattern of the white of subpixel 33 and 34 is used about the subpixel 37 of the center of a pixel 30, and the right end subpixel 38.

[0253] Thus, the pattern amendment means 17 determines the pattern of the subpixel 36-38 of a pixel 30, i.e., the 3 time pattern to a pixel 30, 3 times.

[0254] On the other hand, since conflict is not produced about subpixel 22-24, the pattern of subpixel 22-24 is used for the subpixel 26-28 of a pixel 20. That is, amendment of a pattern is not carried out 3 times to a pixel 20.

[0255] Drawing 25 is instantiation drawing of amendment when the shift action of the pixel 30 of drawing 24 is performed.

[0256] When you make a pixel 20 into an attention pixel, suppose that the pattern and the right-and-left contiguity subpixel pattern were determined 3 times like the subpixel pixels 21-25. Moreover, when you make a pixel 30 into an attention pixel, suppose that the pattern and the right-and-left contiguity

subpixel pattern were determined 3 times like the subpixel pixels 31–35.

[0257] In this case, it is the pattern of the same white and is satisfactory at the overlapping subpixel 25 and subpixel 32.

[0258] However, in the overlapping subpixel 24 and subpixel 31, data differed in black and white and conflict has arisen.

[0259] And in the 3 time pattern which determined the pixel 30 as an attention pixel, and a right-and-left contiguity subpixel pattern (subpixel 31–35), the shift action to the left of a pixel 30 is performed. On the other hand, the shift action is not performed in the 3 time pattern which determined the pixel 20 as an attention pixel, and the right-and-left contiguity subpixel pattern (subpixel 21–25).

[0260] Therefore, the 3 time pattern amendment means 17 gives priority to the 3 time pattern which obtained the pixel 30 to which the shift action was performed as an attention pixel, and a right-and-left contiguity subpixel pattern, i.e., the pattern of subpixel 31–35.

[0261] Therefore, by the subpixel 24 which conflict has generated, and subpixel 31, priority is given to the pattern of the white of the subpixel 31 which obtained the pixel 30 as an attention pixel, and the pattern of the subpixel 28 at the right end of a pixel 20 is determined as white. In subpixel 23 and 22, since there is no conflict, the pattern of the black of subpixel 23 and 22 is used about the subpixel 27 of the center of a pixel 20, and the left end subpixel 26.

[0262] Thus, the pattern amendment means 17 determines the pattern of the subpixel 26–28 of a pixel 20, i.e., the 3 time pattern to a pixel 20, 3 times.

[0263] On the other hand, since conflict is not produced about subpixel 32–34, the pattern of subpixel 32–34 is used for the subpixel 36–38 of a pixel 30. That is, amendment of a pattern is not carried out 3 times to a pixel 30.

[0264] Drawing 26 is instantiation drawing of amendment when right shift actuation of the pixel 20 of drawing 24 and left shift actuation of a pixel 30 are performed.

[0265] When you make a pixel 20 into an attention pixel, suppose that the pattern and the right-and-left contiguity subpixel pattern were determined 3 times like the subpixel pixels 21–25. Moreover, when you make a pixel 30 into an attention pixel, suppose that the pattern and the right-and-left contiguity subpixel pattern were determined 3 times like the subpixel pixels 31–35.

[0266] In this case, in the overlapping subpixel 24 and subpixel 31, patterns differed in black and white and conflict has occurred. On the other hand, patterns differed in black and white and conflict has also produced the overlapping subpixel 25 and subpixel 32.

[0267] And in the 3 time pattern which determined the pixel 20 as an attention pixel, and a right-and-left contiguity subpixel pattern (subpixel 21–25), the shift action to the right of a pixel 20 is performed.

And also in the 3 time pattern which determined the pixel 30 as an attention pixel, and a right-and-left contiguity subpixel pattern (subpixel 31–35), the shift action to the left of a pixel 30 is performed.

[0268] Therefore, in this case, since the shift action is performed on both sides, like drawing 24 or drawing 25, whether the shift action was performed cannot estimate a pattern and conflict cannot be removed by it.

[0269] So, in such a case, the pattern amendment means 17 gives priority to the data of a former image 3 times. That is, the data of the black of the pixel 20 in a former image are used for the subpixel 28 at the right end of [corresponding to the subpixel 24 and 31 which conflict has generated] a pixel 20. On the other hand, the data of the white of the pixel 30 in a former image are used for the subpixel 36 at the left end of [corresponding to the subpixel 25 and 32 which conflict has generated] a pixel 30.

[0270] Thus, the 3 time pattern amendment means 17 amends the pattern of the subpixel 36–38 of a pixel 30, i.e., the 3 time pattern to a pixel 30, while amending the pattern of the subpixel 26–28 of a pixel 20, i.e., the 3 time pattern to a pixel 20.

[0271] Drawing 27 is instantiation drawing of amendment when left shift actuation of the pixel 20 of drawing 24 and right shift actuation of a pixel 30 are performed.

[0272] When you make a pixel 20 into an attention pixel, suppose that the pattern and the right-and-left

contiguity subpixel pattern were determined 3 times like the subpixel pixels 21–25. Moreover, when you make a pixel 30 into an attention pixel, suppose that the pattern and the right–and–left contiguity subpixel pattern were determined 3 times like the subpixel pixels 31–35.

[0273] In this case, in the overlapping subpixel 24 and subpixel 31, patterns differed by white and black and conflict has occurred. On the other hand, patterns differed by white and black and conflict has also produced the overlapping subpixel 25 and subpixel 32.

[0274] And in the 3 time pattern which determined the pixel 20 as an attention pixel, and a right–and–left contiguity subpixel pattern (subpixel 21–25), the shift action to the left of a pixel 20 is performed. And also in the 3 time pattern which determined the pixel 30 as an attention pixel, and a right–and–left contiguity subpixel pattern (subpixel 31–35), the shift action to the right of a pixel 30 is performed.

[0275] Therefore, in this case, since the shift action is performed on both sides, conflict is removed like the case where it is drawing 26 .

[0276] That is, the pattern amendment means 17 gives priority to the data of a former image 3 times. Specifically, the data of the black of the pixel 20 in a former image are used for the subpixel 28 at the right end of [corresponding to the subpixel 24 and 31 which conflict has generated] a pixel 20. On the other hand, the data of the white of the pixel 30 in a former image are used for the subpixel 36 at the left end of [corresponding to the subpixel 25 and 32 which conflict has generated] a pixel 30.

[0277] Thus, the 3 time pattern amendment means 17 amends the pattern of the subpixel 36–38 of a pixel 30, i.e., the 3 time pattern to a pixel 30, while amending the pattern of the subpixel 26–28 of a pixel 20, i.e., the 3 time pattern to a pixel 20.

[0278] Drawing 28 is procedure drawing until it extracts a bit map pattern from a certain former image and performs amendment processing. In addition, in drawing 28 , the pixel and subpixel which attached the slash show black.

[0279] Drawing 28 (a) shows the former image (9x9 pixels). And suppose that the 9–pixel bit map pattern as shown in drawing 28 (b) was extracted. The main attention pixel of the bit map pattern on the left of drawing 28 (b) is white, and the main attention pixel of a right bit map pattern is black.

[0280] Based on this extracted bit map pattern, as shown in drawing 28 (c), a pattern and a right–and–left contiguity subpixel pattern are determined 3 times. In this case, the shift action to the right is performed about a white attention pixel, and the shift action to the left is performed about the black attention pixel.

[0281] Therefore, the 3 time pattern amendment means 17 will remove conflict of the overlapping subpixel in this case according to the example of drawing 26 or drawing 2727 . That is, priority is given to the data of the pixel of a former image, and conflict is removed. Thus, a 3 time pattern as shown in drawing 28 (d) is determined.

[0282] In addition, in drawing 28 (d), the pattern of the subpixel of three left is a 3 time pattern to a white attention pixel, and the pattern of the subpixel of three right is a 3 time pattern to a black attention pixel.

[0283] Drawing 29 is procedure drawing until it extracts a bit map pattern from a certain former image and performs amendment processing.

[0284] Drawing 29 (a) shows the former image (9x9 pixels). And suppose that the 9–pixel bit map pattern as shown in drawing 29 (b) was extracted. The main attention pixel of the bit map pattern on the left of drawing 29 (b) is black, and the main attention pixel of a right bit map pattern is white.

[0285] Based on this extracted bit map pattern, as shown in drawing 29 (c), a pattern and a right–and–left contiguity subpixel pattern are determined 3 times. In this case, the shift action to the left is performed about a black attention pixel, and the shift action to the right is performed about the white attention pixel.

[0286] Therefore, the 3 time pattern amendment means 17 will remove conflict of the overlapping subpixel in this case according to the example of drawing 26 or drawing 2727 . That is, priority is given to the data of the pixel in a former image, and conflict is removed. Thus, a 3 time pattern as shown in

drawing 29 (d) is determined.

[0287] In addition, in drawing 29 (d), the pattern of the subpixel of three left is a 3 time pattern to a black attention pixel, and the pattern of the subpixel of three right is a 3 time pattern to a white attention pixel.

[0288] Now, although the example which removes conflict of the overlapping subpixel and amends a pattern 3 times by the existence of a shift action like drawing 24 – drawing 29 was explained, it does not restrict to this. For example, conflict can also be removed using other valuation bases, such as giving priority to a right-hand side pixel. In short, when conflict has occurred in the overlapping subpixel, the regulation which can determine a pattern as one is defined.

[0289] Now, it returns to explanation of each configuration of drawing 21 . A reference pattern as shown in drawing 23 , and a 3 time pattern and a right-and-left contiguity subpixel pattern relate, and are memorized by the reference pattern storage means 16.

[0290] As mentioned above, with reference to the reference pattern storage means 16, the pattern decision means 15 uses pattern matching like drawing 23 , and determines a pattern and a right-and-left contiguity subpixel pattern 3 times.

[0291] Now, although the above explained an example which determines a pattern and a right-and-left contiguity subpixel pattern 3 times with pattern matching like drawing 23 , a pattern can be expressed in a bit and can also be transformed as follows.

[0292] That is, if black shall be expressed by "0" and white shall be expressed by "1" as shown in drawing 30 , 9-pixel black and white can be expressed by the bit string (9 figures) of "0" or "1" in order from the 9-pixel upper left of a reference pattern to the lower right.

[0293] And as shown in drawing 23 (a), when a 9-pixel reference pattern is black altogether, it can express by the bit string "000000000" and the 3 time pattern to this and a right-and-left contiguity subpixel pattern are set to "00000" (upper case of drawing 30).

[0294] On the contrary, as shown in drawing 23 R> 3 (e), when this 9-pixel reference pattern is white altogether, it can express by the bit string "111111111" and the 3 time pattern to this and a right-and-left contiguity subpixel pattern are set to "11111" (lower berth of drawing 30).

[0295] The regulation which determines a pattern and a right-and-left contiguity subpixel pattern 3 times is beforehand established like [case / where it expresses by such bit string] **** about various patterns which may exist in the medium of a bit string "000000000" and a bit string "111111111." In this case, although it will become 512 kinds as above-mentioned if all regulations are determined, in consideration of symmetric property or the case where it is displayed in white, a part of regulation can be omitted and it can also respond under regulations fewer than 512 kinds.

[0296] And by making a bit string into an index, by the storage structure of an array or other common knowledge, the regulation by these bits is associated and is stored in the reference pattern storage means 16. Then, shortly after lengthening the reference pattern storage means 16 by the index, the 3 time pattern for which it asks, and a right-and-left contiguity subpixel pattern can be obtained.

[0297] Of course, even if it replaces indicating the bit string of 9 figures by the hexadecimal etc. by other equivalent styles, it does not interfere.

[0298] As mentioned above, when the regulation which determines a pattern and a right-and-left contiguity subpixel pattern 3 times is expressed in a bit, the bit string which expressed a reference pattern like drawing 30 in the bit for the reference pattern storage means 16, and a 3 time pattern and a right-and-left contiguity subpixel pattern relate, and is memorized.

[0299] In this case, with reference to the reference pattern storage means 16, the pattern decision means 15 uses retrieval by index like drawing 30 , and determines a pattern and a right-and-left contiguity subpixel pattern 3 times.

[0300] Now, the flow of processing is explained below using the display of drawing 21 R> 1, referring to drawing 31 . However, about the same processing as drawing 13 , explanation is omitted suitably. In drawing 31 , step 1 and step 2 are the same as step 1 of drawing 13 , and step 2.

[0301] At step 3, the display-control means 2 initializes the attention pixel of the bit map pattern extract means 14 to an upper left initial position, and orders the extract of a bit map pattern in case an attention pixel is in an initial position to the bit map pattern extract means 14.

[0302] Then, at step 4, the bit map pattern extract means 14 extracts a 9 pixels (an attention pixel and perimeter pixel) bit map pattern in case an attention pixel is in an initial position from the former image data of the former image data storage means 6, and returns it to the display-control means 2.

[0303] The display-control means 2 will order the decision of the 3 time pattern and right-and-left contiguity subpixel pattern which suit delivery and this bit map pattern to the pattern decision means 15 in this, if a 9-pixel bit map pattern is received from the bit map pattern extract means 14.

[0304] Then, the pattern decision means 15 asks for the reference pattern which suits the bit map pattern which searched the 3 time pattern and right-and-left contiguity subpixel pattern decision rule of the reference pattern storage means 16 (step 5), and was received, asks for the 3 time pattern corresponding to the reference pattern for which it asked, and a right-and-left contiguity subpixel pattern (step 6), and passes the result to the pattern amendment means 17 3 times.

[0305] If the pattern amendment means 17 receives a pattern and a right-and-left contiguity subpixel pattern 3 times 3 times, conflict of the pattern of the overlapping subpixel is amended, the 3 time pattern to an attention pixel is determined (step 7), and the result is stored in the image data storage means 11 3 times (step 8).

[0306] The display-control means 2 performs processing from step 4 to step 8 repeatedly until the processing about all attention pixels is completed, updating an attention pixel (step 10) (step 9). And when the pattern amendment means 17 stores a pattern in order 3 times 3 times, the information equivalent to the image shown in drawing 15 will be stored in the image data storage means 11 3 times.

[0307] Processing of the step 11 after this repeat processing is completed – step 14 is the same as that of step 13 of drawing 13 – step 16.

[0308] Now, the pattern decision means 15 explains below an example of a concrete procedure which determines a pattern and a right-and-left contiguity subpixel pattern 3 times with pattern matching using a drawing.

[0309] Drawing 32 is instantiation drawing of the concrete procedure in which the pattern decision means 15 determines a pattern and a right-and-left contiguity subpixel pattern 3 times with pattern matching.

[0310] As shown in drawing 32, the pattern decision means 15 scans nine pixels p0-p8 containing the main attention pixel p8, and generates the address.

[0311] The pattern decision means 15 uses as a pattern and a right-and-left contiguity subpixel pattern the data (5 bits) of the table corresponding to the address which searched the table of the reference pattern storage means 16, and was generated 3 times.

[0312] Thus, the 3 time pattern and right-and-left contiguity subpixel pattern which were determined are assigned to three subpixel which constitutes an attention pixel, and the right-and-left contiguity subpixel of an attention pixel after amendment processing by the 3 time pattern amendment means 17 and filtering processing by the filtering processing means 12 are performed.

[0313] Here, the above-mentioned table which the reference pattern storage means 16 has is explained. Since it is referred to as $n=m=1$, the address in which the class of bit map pattern in which it is extracted with the bit map pattern extract means 14, and deals becomes 512 kinds, and it is generated and deals also becomes 512 kinds.

[0314] Therefore, the reference pattern storage means 16 has 512 tables corresponding to 512 kinds of this address.

[0315] According to the pattern and the right-and-left contiguity subpixel pattern decision rule, the pattern and the right-and-left contiguity subpixel pattern (5-bit data) are stored in each table 3 times 3 times.

[0316] Now, as mentioned above, with the gestalt of this operation, to all attention pixels, the pattern

and the right-and-left contiguity subpixel pattern were determined 3 times, and the 3 time pattern without conflict has been further obtained by amendment by the pattern amendment means 17 3 times. [0317] Therefore, as a result of performing same "the shift action" as the gestalt 1 of operation, a pixel can be moved to right and left by one subpixel, without changing a pixel value.

[0318] For this reason, in indicating by subpixel like the gestalt 1 of operation, dispersion in the concentration of the output image resulting from the line breadth showing objects (an alphabetic character, a notation, graphic forms, or those combination) changing can be controlled. Consequently, a high quality subpixel display is realizable.

[0319] Moreover, in order for the pattern decision means 15 to determine dynamically a pattern and a right-and-left contiguity subpixel pattern 3 times about all attention pixels in step 4 of drawing 31 – step 6, it is not necessary to hold statically a pattern and a right-and-left contiguity subpixel pattern 3 times.

[0320] Therefore, compared with the case where a pattern and a right-and-left contiguity subpixel pattern are stored statically 3 times, the burden of a system can be mitigated and a cellular phone, a mobile computer, etc. can be applied also to a device with many limits of a system resource.

[0321] Furthermore, a 3 time pattern and a right-and-left contiguity subpixel pattern do not need to be known. [as opposed to this raster image to a raster image list.] For this reason, for example, about the image of large range, such as a photograph-of-his-face image downloaded from the server, the subpixel display which improved resolution substantially can be performed and it can display legible.

[0322] In addition, it cannot be overemphasized that the above-mentioned effectiveness is not limited like the gestalt 1 of operation in the case of $x=y=1$.

[0323] However, especially in the case of $x=y=1$, the following effectiveness is done so. It becomes respectively [a pattern on either side] that conflict may arise in the 3 time pattern to an attention pixel in the case of $x=y=1$, and a pattern to be amended is set to two even if many.

[0324] On the other hand, it becomes respectively [the pattern of a center and the left] that conflict may produce $x \geq 2$ grade, for example, the case of $x=y=2$, in the 3 time pattern to an attention pixel at the pattern of a center and the right; and a list, and amendment processing becomes complicated.

[0325] For this reason, $x=y=1$, then the 3 time pattern amendment means 17 can remove conflict by simple processing compared with the case where it considers as $x \geq 2$ grade.

[0326] (Gestalt 4 of operation) Next, the gestalt 4 of operation of this invention is explained. About the configuration of the gestalt 4 of operation, only a point of difference with the gestalt 3 of operation is explained. Drawing 33 is the block diagram of the indicating equipment in the gestalt 4 of operation of this invention.

[0327] With the gestalt of this operation, unlike the gestalt 3 of operation, a pattern decision rule is not memorized 3 times, but it asks by logical operation processing. That is, as shown in drawing 33, to drawing 21, it replaced with the reference pattern storage means 16, and the pattern logical operation means 18 is established.

[0328] The case where processing which determines a pattern and a right-and-left contiguity subpixel pattern 3 times is hereafter performed as $n=m=1$ and $x=y=1$ is mentioned as an example, and is explained.

[0329] The logical operation of the pattern logical operation means 18 is explained referring to drawing 34. The pattern logical operation means 18 consists of functions which perform conditional judgment after drawing 34 (b), and return the bit value of 5 figures which determines a pattern and a right-and-left contiguity subpixel pattern 3 times as a return value to the decision result like drawing 34 (a) about a main attention pixel (0 0) and the pixel (a total of three $x3$ pixels) which adjoins this.

[0330] Here, after drawing 34 (b), "*" means that monochrome any are sufficient, and is set to black =1 and white =0.

[0331] For example, as shown in drawing 34 (b), a return value will be set to "11111" if the pixel which has an attention pixel in right and left of an attention pixel black is also black.

[0332] Moreover, as shown in drawing 34 (c), a return value will be set to "00000" if the pixel which has

an attention pixel in right and left of an attention pixel in white is also white.

[0333] In addition, the logic which can carry out data processing is prepared in the pattern logical operation means 18 like drawing 34 (d), (e), and --.

[0334] Thereby, also in the gestalt 4 of operation, it will be understood like the gestalt 3 of operation that a pattern and a right-and-left contiguity subpixel pattern can be determined 3 times. Therefore, since a shift action is performed like the gestalt 3 of operation, the same effectiveness as the gestalt 3 of operation is done so.

[0335] Moreover, it can be made easy to mount in a device with a severe limit of a storage region, since it does not depend on a storage region but is based on data processing with the gestalt 4 of operation.

[0336] Next, the flow of processing is explained using the display of drawing 33, referring to drawing 35. However, it explains focusing on different processing from drawing 31. That is, in drawing 35, it replaced with step 5 (the reference pattern storage means 16 is searched) of drawing 31, and a different step 5 (pattern logical operation) from this is formed.

[0337] A pattern decision means 15 by which the decision of a pattern and a right-and-left contiguity subpixel pattern was able to be ordered 3 times makes logical operation which was mentioned above for the pattern logical operation means 18 perform from the display-control means 2 at step 5 in drawing 35.

[0338] And the pattern decision means 15 acquires the return value at step 6. It means that the pattern and the right-and-left contiguity subpixel pattern were determined 3 times by this.

[0339] Next, the pattern decision means 15 stores the 3 time pattern by this return value, and a right-and-left contiguity subpixel pattern in the image data storage means 11 3 times at step 7.

[0340] Other processings are the same as that of drawing 31. In addition, it cannot be overemphasized that the configuration which combined the gestalt 3 of operation and the gestalt 4 of operation is also included by this invention. For example, two steps of processings which consist of processing by the reference pattern storage means 16 and processing by the pattern logical operation means 18 may be performed. Under the present circumstances, after the point of processing by the reference pattern storage means 16 and processing by the pattern logical operation means 18 is not asked.

[0341] In addition, the effect of the invention is explained.

[Effect of the Invention] In invention claims 1 and 13 and given in 25, it hits performing a subpixel display and a smoother display can be realized compared with the case where the line breadth of the object of a former image is expanded or reduced simply.

[0342] By invention claims 2 and 14 and given in 26, a pixel can be moved in the 1st direction by the migration width of face for one subpixel according to the value of "x" and "y", without changing a pixel value.

[0343] For this reason, in indicating by subpixel, dispersion in the concentration of the output image resulting from the line breadth showing an object changing can be controlled. Consequently, a high quality subpixel display is realizable.

[0344] Moreover, since processing which determines a pattern and the pattern of subpixel 3 times is performed only when it has the value at which the attention pixel was appointed beforehand, as compared with the case where these are determined to all attention pixels, the whole throughput is mitigable. Consequently, the burden of a system can be mitigated and a cellular phone, a mobile computer, etc. can be applied also to a device with many limits of a system resource.

[0345] And in order to determine a pattern and the pattern of subpixel dynamically 3 times, it is not necessary to hold a pattern and the pattern of subpixel statically 3 times. Therefore, compared with the case where a pattern and the pattern of subpixel are stored statically 3 times, the burden of a system is mitigable. thereby -- the above-mentioned effectiveness and a device with many [conjointly] limits of a system resource -- receiving -- more -- application -- it becomes easy.

[0346] By invention claims 3 and 15 and given in 27, a pixel can be moved in the 1st direction by the migration width of face for one subpixel according to the value of "x" and "y", without changing a pixel value.

[0347] For this reason, in indicating by subpixel, dispersion in the concentration of the output image resulting from the line breadth showing an object changing can be controlled. Consequently, a high quality subpixel display is realizable.

[0348] And since it is removed, the conflict produced to a pattern 3 times does not need to process by sorting out a specific attention pixel, is performing the same processing uniformly to all attention pixels, and can determine a pattern and the pattern of subpixel 3 times.

[0349] Moreover, in order to determine a pattern and the pattern of subpixel dynamically 3 times, it is not necessary to hold a pattern and the pattern of subpixel statically 3 times. Therefore, compared with the case where a pattern and the pattern of subpixel are stored statically 3 times, the burden of a system can be mitigated and a cellular phone, a mobile computer, etc. can be applied also to a device with many limits of a system resource.

[0350] In invention claim 4 and given in 16, compared with the case where it considers as $x \geq 2$ grade, the migration width of face of a pixel becomes small, and crushing, such as the object displayed on a display device, for example, an alphabetic character etc., can be controlled.

[0351] In invention claim 5 and given in 17, it becomes respectively [a pattern on either side] that conflict may arise in a pattern 3 times based on an attention pixel, and it can remove conflict by simple processing compared with the case where it considers as $x \geq 2$ grade.

[0352] In invention claim 6 and given in 18, it becomes the thing excluding the attention pixel from the pixel group of the rectangle of 3x3, the case where a reference pattern can take becomes 256 kinds, and a reference pattern can realize a subpixel display by simple processing.

[0353] In invention claim 7 and given in 19, a reference pattern is the pixel group of the rectangle of 3x3, the case where a reference pattern can take becomes 512 kinds, and simple processing can realize a subpixel display.

[0354] In invention claim 8 and given in 20, it indicates by subpixel also with the image of various formats.

[0355] In invention claim 9 and given in 21, by reference of a reference pattern storage means, since a pattern and the pattern of subpixel are determined 3 times, a high speed can be asked for a pattern and the pattern of subpixel 3 times, and the response of a display can be held good.

[0356] In invention claim 10 and given in 22, pattern matching can determine a pattern and the pattern of subpixel 3 times.

[0357] A pattern and the pattern of subpixel can be searched with invention claim 11 and given in 23 at high speed and easily 3 times by the bit string.

[0358] In invention claim 12 and given in 24, since a pattern and the pattern of subpixel can be determined 3 times only by logical operation even if it has not memorized the reference pattern, a storage region can be saved.

[Translation done.]

*** NOTICES ***

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1.This document has been translated by computer. So the translation may not reflect the original precisely.

2.**** shows the word which can not be translated.

3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] The block diagram of the indicating equipment in the gestalt 1 of operation of this invention

[Drawing 2] Definition drawing of the reference pattern in the gestalt 1 of operation of this invention

[Drawing 3] (a) Instantiation drawing of a said reference pattern

(b) Instantiation drawing of this 3 time pattern and a right-and-left contiguity subpixel pattern

(c) Instantiation drawing of a said reference pattern

(d) Instantiation drawing of this 3 time pattern and a right-and-left contiguity subpixel pattern

(e) Instantiation drawing of a said reference pattern

(f) Instantiation drawing of this 3 time pattern and a right-and-left contiguity subpixel pattern

[Drawing 4] (a) The explanatory view of this shift action

(b) An explanatory view in case a shift action is not performed

[Drawing 5] (a) The explanatory view of this effectiveness

(b) The explanatory view of this effectiveness

(c) The explanatory view of this effectiveness

[Drawing 6] (a) Instantiation drawing of a former image in case this shift action is not performed

(b) The explanatory view of inconvenience which may be generated when it is assumed that the shift action was performed

[Drawing 7] (a) Instantiation drawing of a said reference pattern

(b) Instantiation drawing of this 3 time pattern and a right-and-left contiguity subpixel pattern

(c) Instantiation drawing of a said reference pattern

(d) Instantiation drawing of this 3 time pattern and a right-and-left contiguity subpixel pattern

(e) Instantiation drawing of a said reference pattern

(f) Instantiation drawing of this 3 time pattern and a right-and-left contiguity subpixel pattern

[Drawing 8] Instantiation drawing of the image which indicated by subpixel by using the image of drawing

6 (a) as a former image according to the regulation of drawing 7

[Drawing 9] (a) The explanatory view of five subpixel to which a pattern and a right-and-left contiguity subpixel pattern are assigned the said 3 times

(b) The explanatory view of the left shift actuation for this one subpixel

(c) An explanatory view without this shift action

(d) The explanatory view of the right shift actuation for this one subpixel

[Drawing 10] (a) The explanatory view of six subpixel to which a pattern and a right-and-left subpixel pattern are assigned the said 3 times

(b) The explanatory view of the left shift actuation for this one subpixel

(c) An explanatory view without this shift action

(d) The explanatory view of the right shift actuation for this one subpixel

(e) The explanatory view of the right shift actuation for these two subpixel

[Drawing 11] (a) said -- the explanatory view of the effectiveness at the time of being referred to as $x=y=1$

(b) said -- the explanatory view of the effectiveness at the time of being referred to as $x=y=1$

[Drawing 12] Related drawing of this bit string, a 3 time pattern, and a right-and-left contiguity subpixel pattern

[Drawing 13] The flow chart of this indicating equipment

[Drawing 14] (a) Instantiation drawing of this dimension image

(b) Instantiation drawing of this extract bit map pattern

(c) Instantiation drawing of this 3 time pattern and a right-and-left contiguity subpixel pattern

[Drawing 15] Instantiation drawing of this 3 time image

[Drawing 16] Instantiation drawing of this subpixel display

[Drawing 17] This 3 time pattern and instantiation drawing of a right-and-left contiguity subpixel pattern decision procedure

[Drawing 18] The block diagram of the indicating equipment in the gestalt 2 of operation of this invention

[Drawing 19] (a) Definition drawing of a said reference pattern

(b) Related drawing with a said reference pattern, a 3 time pattern, and a right-and-left contiguity subpixel pattern

(c) Related drawing with a said reference pattern, a 3 time pattern, and a right-and-left contiguity subpixel pattern

(d) Related drawing with a said reference pattern, a 3 time pattern, and a right-and-left contiguity subpixel pattern

(e) Related drawing with a said reference pattern, a 3 time pattern, and a right-and-left contiguity subpixel pattern

[Drawing 20] The flow chart of this indicating equipment

[Drawing 21] The block diagram of the indicating equipment in the gestalt 3 of operation of this invention

[Drawing 22] Definition drawing of a said reference pattern

[Drawing 23] (a) Instantiation drawing of a said reference pattern

(b) Instantiation drawing of this 3 time pattern and a right-and-left contiguity subpixel pattern

(c) Instantiation drawing of a said reference pattern

(d) Instantiation drawing of this 3 time pattern and a right-and-left contiguity subpixel pattern

(e) Instantiation drawing of a said reference pattern

(f) Instantiation drawing of this 3 time pattern and a right-and-left contiguity subpixel pattern

[Drawing 24] Instantiation drawing of this 3 time pattern amendment processing

[Drawing 25] Other instantiation drawings of this 3 time pattern amendment processing

[Drawing 26] Instantiation drawing of further others of this 3 time pattern amendment processing

[Drawing 27] Instantiation drawing of further others of this 3 time pattern amendment processing

[Drawing 28] (a) Instantiation drawing of this dimension image

(b) Instantiation drawing of the said-extracted bit map pattern

(c) Instantiation drawing of the said-determined 3 time pattern and a right-and-left contiguity subpixel pattern

(d) Instantiation drawing of the 3 time pattern after this amendment

[Drawing 29] (a) Other instantiation drawings of this dimension image

(b) Instantiation drawing of the said-extracted bit map pattern

(c) Instantiation drawing of the said-determined 3 time pattern and a right-and-left contiguity subpixel pattern

(d) Instantiation drawing of the 3 time pattern after this amendment

[Drawing 30] Related drawing of this bit string, a 3 time pattern, and a right-and-left contiguity subpixel pattern

[Drawing 31] The flow chart of this indicating equipment

[Drawing 32] This 3 time pattern and instantiation drawing of a right-and-left contiguity subpixel pattern decision procedure

[Drawing 33] The block diagram of the indicating equipment in the gestalt 4 of operation of this invention

[Drawing 34] (a) Definition drawing of a said reference pattern

(b) Related drawing with a said reference pattern, a 3 time pattern, and a right-and-left contiguity subpixel pattern

(c) Related drawing with a said reference pattern, a 3 time pattern, and a right-and-left contiguity subpixel pattern

(d) Related drawing with a said reference pattern, a 3 time pattern, and a right-and-left contiguity subpixel pattern

(e) Related drawing with a said reference pattern, a 3 time pattern, and a right-and-left contiguity subpixel pattern

(f) Related drawing with a said reference pattern, a 3 time pattern, and a right-and-left contiguity subpixel pattern

(g) Related drawing with a said reference pattern, a 3 time pattern, and a right-and-left contiguity subpixel pattern

[Drawing 35] The flow chart of this indicating equipment

[Drawing 36] The conventional one-line mimetic diagram

[Drawing 37] Instantiation drawing of the conventional former image

[Drawing 38] Instantiation drawing of the conventional 3 time image

[Drawing 39] The explanatory view of the conventional color decision process

[Drawing 40] (a) The explanatory view of the conventional filtering processing multiplier

(b) Instantiation drawing of the conventional filtering processing result

[Description of Notations]

1 Display Information Input Means

2 Display-Control Means

3 Display Device

4 Display Image Storage Means

5 Former Image Data Constellation Storage Means

6 Former Image Data Storage Means

7 Attention Pixel Judging Means

8 14 Bit map pattern extract means

9 15 Pattern decision means

10 16 Reference pattern storage means

11 3 Time Image Data Storage Means

12 Filtering Processing Means

13 18 Pattern logical operation means

17 3 Time Pattern Amendment Means

[Translation done.]